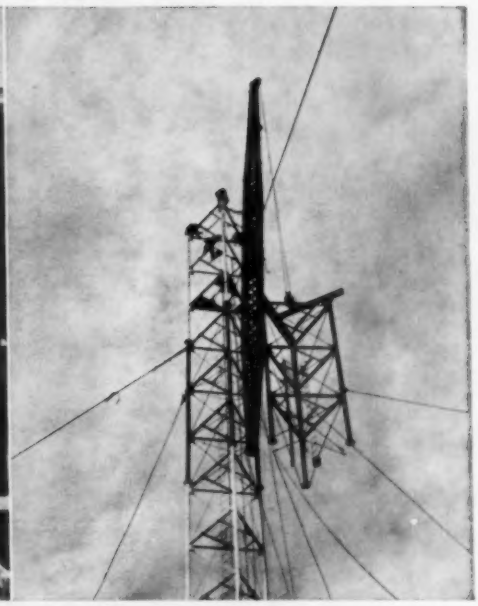
Welding Engineer

MAY, 1961
50 Cents



CONSTRUCTION WELDING

University Microfilms Inc
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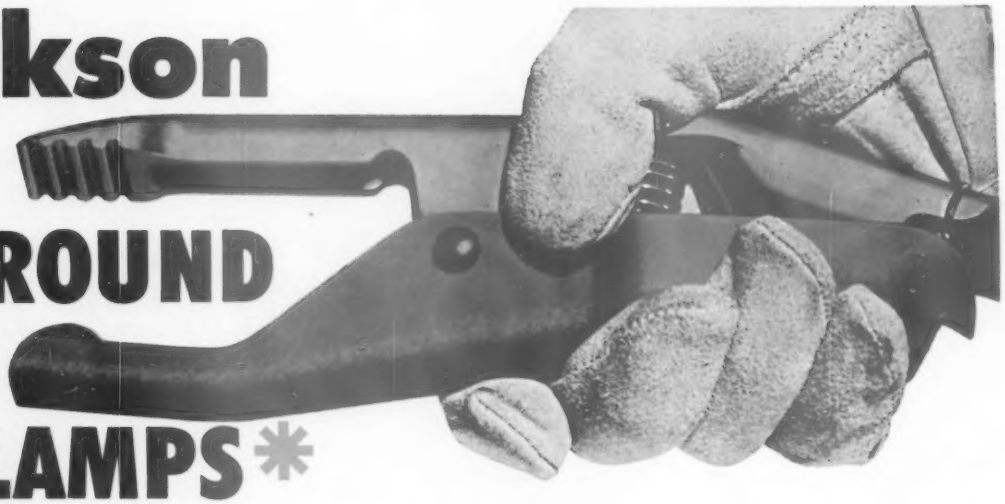
Jackson GROUND CLAMPS*



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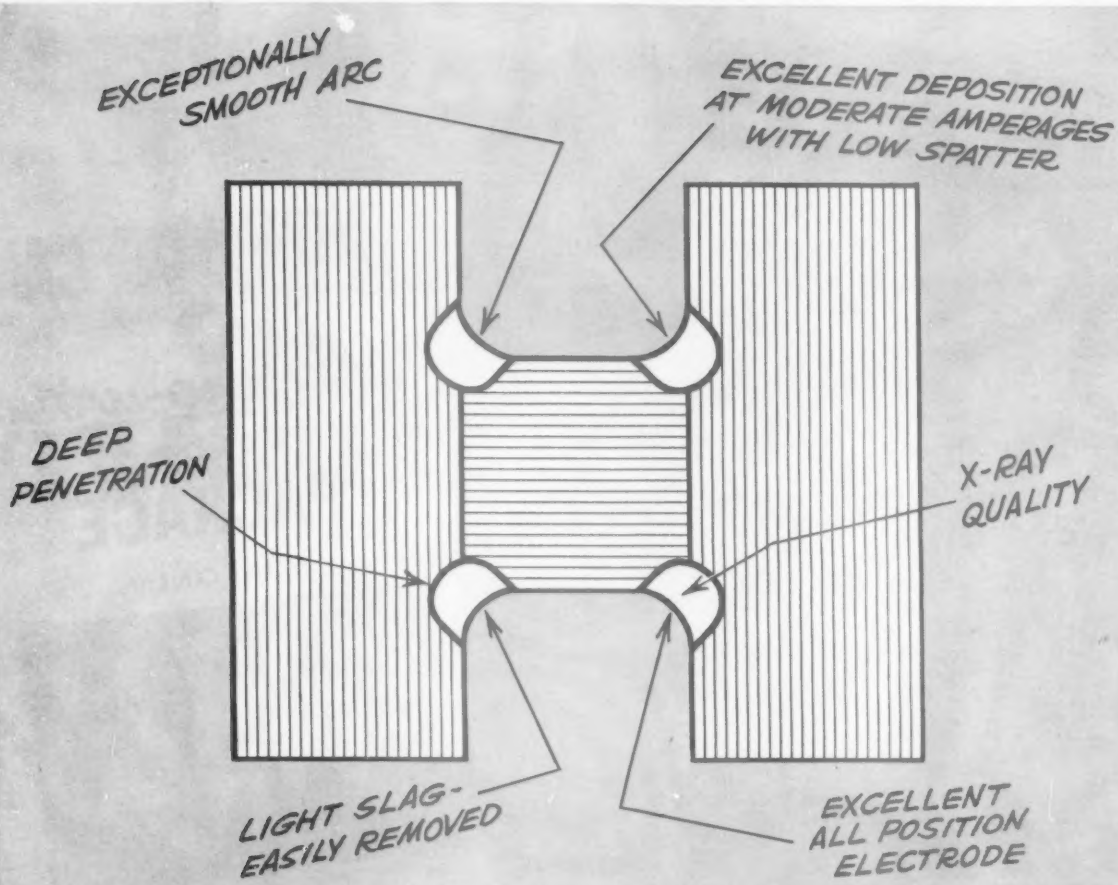

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VOL. 46—No. 5

Welding Engineer

The magazine of joining and severing of materials

This is welding: May, 1961

Cover . . . construction welding on a bank building, a television tower and a missile launch-cell door, as detailed in this issue.

CONSTRUCTION WELDING

Weld-wax — a new method joins diodes 43
Fabrication of miniature encapsulated electronic assemblies presents some delicate joining problems which only welding can solve adequately. So a high-speed production method was developed using welding and wax-injection, as explained by author **A. W. Sweet.**

World's tallest structure — design said "weld it" 46
To build a television tower 204 ft taller than the Empire State Building, design demanded the most effective and economical fabrication method. The welding specifications are detailed by authors **Elda Jones** and **K. H. Zeigler.**

1,280 tons of blast-proof doors for missile site 48
Missile facilities require giant doors on the launch-cells. And 16 of these 80-ton behemoths were fabricated from scratch by one firm using submerged-arc and manual metal-arc welding processes, as reported by **Howard E. Jackson.**

Old standby — A-7 steel — used in all-welded bank 50
An all-welded A-7 steel frame and a column-free main tower are the main ingredients in this 16-story bank building, with four floors still to be built adjoining the tower section. Author **E. E. Hanks** describes the construction welding.

Wire fabric finds new markets 52
Reinforcing welded wire fabric is now being used as an electric heating element in a North Dakota building, and in concrete water ducts crossing the Niagara River in up-state New York, creating new markets for a much-used product.

Analyze your hardfacing job using these procedures 70
A thorough investigation of a hardfacing job to determine what the part is, what the function of the hardfacing will be, and what type of wear exists will greatly simplify the job's execution.
(For a reprint of this article, circle 250 on Welding Info-Aid Card.)

Also in this issue:

Automatic welder joins aluminum gas line 54
Low-cost sandwich panels roll welded 63
Speed auto-body production by 40% 64
Flame-straightening restores fire distorted steel 80
New weldable 18% nickel steel has high ductility 85

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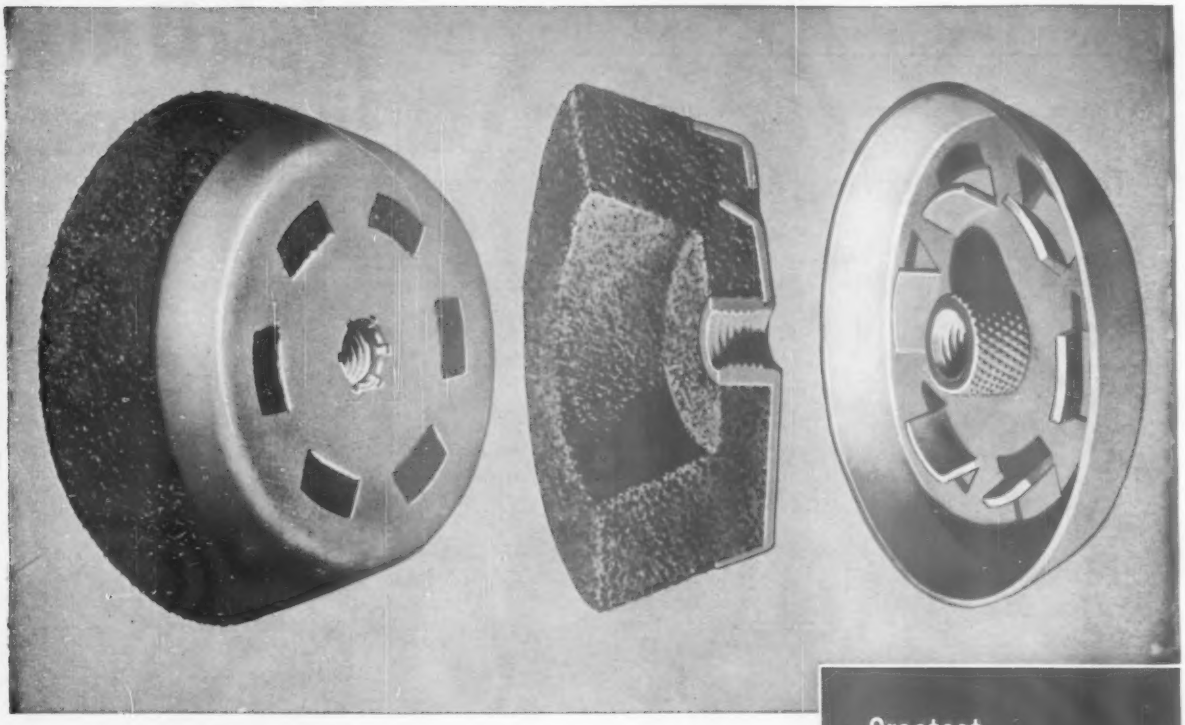

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Welding Engineer

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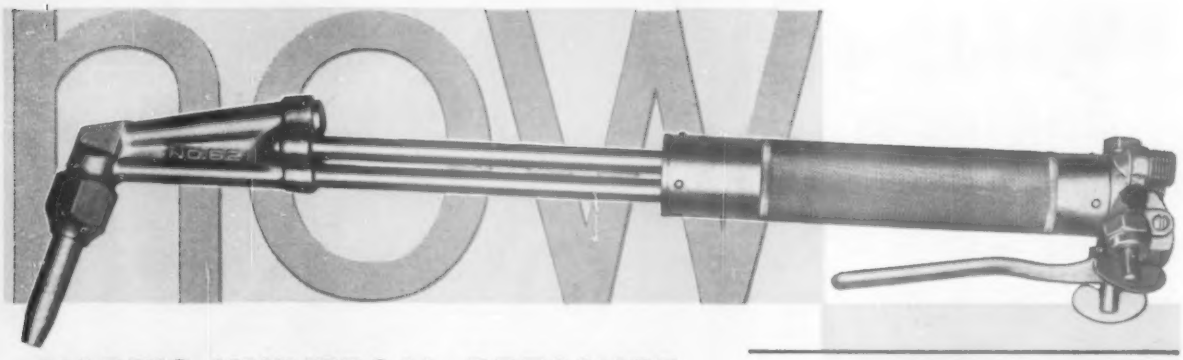

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- All items are Underwriters' Laboratories approved.

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WIDE RANGE OF TIPS AVAILABLE FOR:

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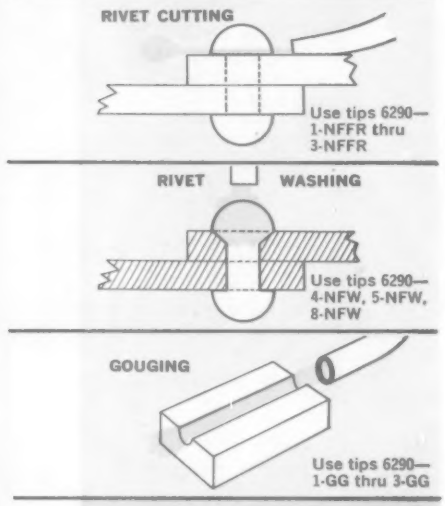

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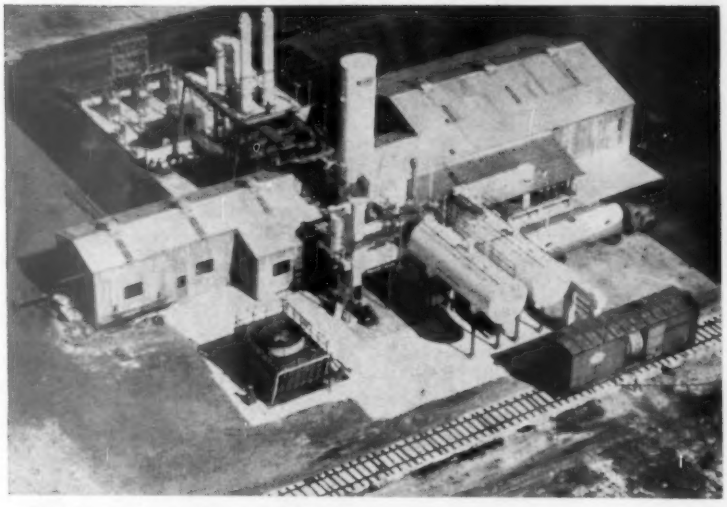
May Headlines



FLORIDA'S first liquid air separation plant, built in Tampa by Air Reduction Sales Co., features a new style of partial outdoor construction. Tall cylindrical structure rising from middle of main building is fractioning column where air is separated into component gases.

Airco opens air separation plants in Florida, Louisiana

Two Gulf Coast air separation plants have been opened by Air Reduction Sales Co., New York City.

One is located in Tampa, Fla., and the other in Baton Rouge, La.

The two plants are supplying liquefied gases — oxygen, nitrogen, and argon — to petroleum and petrochemical producers in Texas and Louisiana, citrus processors in Florida, metalworking factories, shipyards and other industries in the South.

The two plants are almost identical. Both draw air into the plant at 131,000 cfh. Peak production capacity for each plant is 30 tons of liquefied gas a day.

The Tampa plant, located on a 22-acre site, includes air intake and compression equipment, an air-separation column, storage tanks, a control panel and cylinder filling facilities, a district sales office and a laboratory.

The multi-million dollar plant is headed by J. W. Sturdivent.

Product inquiries high at Western Metal Show

American Society for Metals, Metals Park, Ohio, reports an unexpectedly high number of inquiries for product information from visitors at the 12th Western Metal Show held recently in Los Angeles.

During the 5-day event 23,963 people were issued registration cards. In 32 sessions, more than 125 papers were presented.

Largest single sale reported during the show was made when Machinery Sales Co., Los Angeles, gave Bridgeport Machinery Co. a $1,250,000 machinery order.

Railroad men complete aluminum welding course

Representatives of eight top railroad car builders in the United States recently completed a week-long course in advanced aluminum welding principles.

The course was held at the North American research center of Aluminium Ltd. —Aluminium Laboratories Ltd., Kingston, Ont.

Weld quality course offered for home study

A home-study training program is being offered by National Technical Training Services for individuals interested in quality control and inspection of welds.

A written examination must be passed to gain a certificate in the 14-lesson course. Information can be obtained from NTTS at 260 Delaware Ave., Buffalo 2, N.Y.

Chemclean establishes Canadian company

Chemclean Products Corp., College Point, N.Y., has formed an affiliated company, Chemclean Products of Canada, Ltd., 72 Crockford Blvd., Scarborough, Toronto.

The Canadian firm will produce a complete line of industrial cleaners, strippers and proprietary chemicals.

New crane girders

RADICAL design change for overhead traveling cranes includes this pressurized and well-lighted passageway inside main girder, running length of crane. Area is used for electronic controls and power components. Improved electronic controls also contribute to this new crane manufactured by Harnischfeger Corp., Milwaukee.

COMING EVENTS

MAY 8-10: 17th Annual Convention, NWSA, Hotel Commodore, New York City.

MAY 22-25: The Design Engineering Show, Cobo Hall, Detroit.

JUNE 8-9: First Western Conference, NEMA, Biltmore Hotel, Los Angeles.

JUNE 12-23: Summer Conference Course, Fundamentals of Welding Engineering, The Ohio State University, Columbus, Ohio.

JULY 4-7: 27th Annual Meeting, The National Society of Professional Engineers, Olympic Hotel, Seattle, Wash.

JULY 18-20: Western Plant Maintenance and Engineering Show & Conference, Pan Pacific Auditorium, Los Angeles.

JULY 21-23: Eastern Regional Meeting, AIRPS, The Schine Inn, Chicopee, Mass.

Haynes Stellite exhibits at Design Engineering Show

Haynes Stellite Co., New York City, will exhibit new products and recent technological advances in the metals industry at the Design Engineering Show on May 22-25 at Cobo Hall, Detroit.

The show will also feature a conference with reports from automobile company executives on how they measure and meet public tastes. The conference will be sponsored by the machine design division of the American Society of Mechanical Engineers.

AEC free-loans film on radioisotopes

The Atomic Energy Commission has available for free-loan or purchase a new 57-minute color motion picture titled, "Industrial applications of radioisotopes."

The 16mm semi-technical film is a survey of current widespread uses of radioisotopes in industry including radiography.

SUPERVISORS, attending Hobart Bros. Technical School welding workshop courses for management, follow up lecture session with practical coil construction demonstration.

Supervisors study welding at Hobart workshop

Short workshop courses designed to upgrade the ability of key personnel to direct, control and evaluate fusion welding operations are being conducted by Hobart Bros. Technical School, Troy, Ohio.

The school is run on a twice-a-month basis with one-week courses.

The school is also conducting one-week welding refresher courses for industrial arts and vocational agricultural teachers during June, July and August.

ASTME to hear about flexible fiber probes

Fiber optics (glass ropes), which can be used for inspecting inaccessible recesses in industrial equipment, will be discussed during the American Society of Tool and Mfg. Engineers Convention in New York City, May 22 to 26.

One of 50 papers to be presented at the conference on welding, forging and cutting and other subjects will be on the new flexible probes which can be used for inspecting pipes, turbines and other awkward spots.

Stephen M. Mac Neille, director of research for American Optical Co., Southbridge, Mass., will present a paper on the subject on May 22 at the Statler Hotel during the meeting.

Fansteel acquires Wesson Tool Co.

Fansteel Metallurgical Corp., North Chicago, Ill., has contracted to acquire Wesson Tool Co., Detroit.

The purchased Wesson complex will include Wesson Multicut Corp., Wesson Metal Corp. (including Archer & Smith Div.), and Wesson Co. The purchase price will be paid in cash and promissory notes.

All-State holds national sales meeting

All-State Welding Alloys Co., Inc., recently conducted its annual technical sales seminar at its home offices in White Plains, N.Y.

Guest speakers and panelists from customer firms joined regional managers from the United States, Central America and Canada for open forum discussions during the 4-day seminar.

Jackson Products' new home

MANUFACTURING operations of Jackson Products, Air Reduction Sales Co., have been moved to this new plant at 5523 Nine Mile Road, Warren, Mich. Jackson gains a 100% increase in floor space in the new building.

Nickel production starts at Thompson development

Commercial production of refined nickel at the second largest nickel operation in the world is now under way.

The development at Thompson, Manitoba, is part of The International Nickel Co. of Canada, Ltd. The $185-million project raises Inco's annual nickel production capacity to 385 million pounds.

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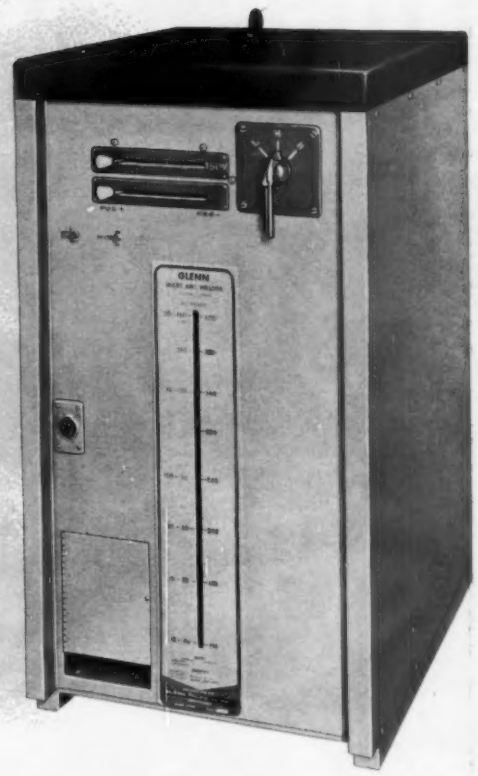

Balanced-Wave ac output for aluminum, magnesium and alloys requiring ac current. Capacitor bank in output circuit to block dc feedback and use of non-saturable components assures uniform electron flow in both directions for better cleaning action, improved welding.

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Output	Model BW400AC	BW400AC/DC
Open circuit, ac	100 or 150 v	150 v
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Current Ranges (@ 20v)		
Low	25-58 amps	
Medium	53-175 amps	
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If you want the finest TIG performance **plus** cost-cutting versatility in one compact, convenient "package", Glenn BW400 Power Supplies are definitely the answer. Write today for literature, specifications and prices. (Manufactured under license, Patent No. 2,472,323.) "Heliarc," reg. TM's of Union Carbide Corporation

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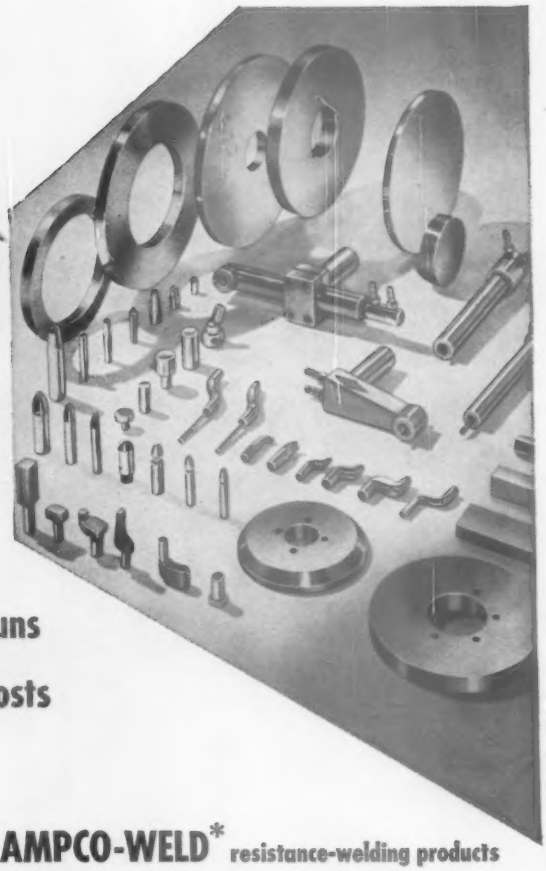

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AMPCO-WELD resistance-welding holders — to suit every job — straight, offset, and universal ejector models. Offset and universal holders have interchangeable sockets for No. 1 and No. 2 Morse tapers. You change tapers without changing holders.

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RW-15

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*Reg. U. S. Pat. Off.

In retrospect

(Taken from **Welding Engineer** issues of May, 1916, 1931 and 1946)

—45 Years Ago—

. . . That a national organization of welding interests would serve a useful purpose, if properly organized and managed, there can be no doubt. . . . The association should represent welding interests of every character. We are frank to confess that such a group looks good to the Editor.

The main office of the Goldschmidt Thermit Co. has been moved from 90 West Street, New York City, to 129 Broadway, which is the Equitable Building.

—30 Years Ago—

The American Welding Society has awarded the Samuel Wylie Miller Memorial Medal to E. H. Ewertz, a past president of AWS and a consulting engineer widely known as one of the pioneers in the welding industry.

Fred Schramm was elected president of the Southwest Welding Association. W. F. Mosher, Jr., was re-elected first vice president; W. M. Murphy was named second vice president; and M. C. Stone was re-elected secretary-treasurer.

—15 Years Ago—

J. A. Cunningham, T. F. Ryan and H. F. Flynn, all formerly of Arcway Equipment Co., Philadelphia, have formed their own company, J. A. Cunningham Equipment, Inc., with headquarters in Philadelphia.

Roy Norton has resigned as general sales manager of Alloy Rods Co., York, Pa., to form his own company, Norton Welding Equipment Co. in Milwaukee.

The Bergstrom Alloys Corp., Reno, Nev., has changed its name to Industrial Overlay Metals, Inc., and will have offices in Chicago. A new plant will be built in Ohio. The Bergstrom trade name will be retained.

Welding Problem?

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Your welding supply distributor has a wealth of information for you. Let him demonstrate how you can hold trouble free welding in the palm of your hand.

Cool, efficient operation is the key to better profits in the welding industry. Your welding supply distributor will be glad to share his knowledge with you. Why not take a few minutes to talk over your welding troubles with him. He knows your problems and will get you back in trouble free operation in a jiffy.

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Nothing to crack up here! **If rough handling** is frequent in your operation, you'll save money for your company by installing new Airco Gaugeless Regulators.

Specify Airco—industry's most complete line of quality regulators, gas welding and cutting torches, tips, electrodes, spotwelders, welding machines, supplies and high purity industrial gases. Look for your nearest Authorized Airco Distributor in your Classified Telephone Directory, under "Welding Equipment and Supplies."

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Letters

Structural welding

I read the comments on structural construction welding in the January issue (*See "Welding leaders look to the future,"* WE, *Jan. p.* 52). I am a certified weldor, boilermaker and ironworker in field construction.

If you could see the equipment and material we have to use to do our job, you would scratch your head and laugh.

I think the state and insurance companies should get after the contractors and inspect all welds and have foremen and sub-foremen who know how to read a print with the welding code and also know how to weld.

Let the weldor see the print. If he is a weldor, he will know what to do. I have met a lot of men who think they can read a print, but don't know how to hook up a machine and can't tell one rod from another. They turn up the machine and make a pass up or down, wet or dry, flux or no flux, or however it will stick after picking up a rod from the ground.

Rivets and bolts are inspected. Why not welds?

Joseph J. Kozik
Erie, Pa.

Welding evangelists?

Down through the years I have noted with interest your stimulating editorials. The welding industry would do well to hire and commission you as their Billy Graham—converting the masses to welding.

Martin P. Korn
Consulting Engineer
Boca Raton, Fla.

Letters should be addressed to: The Editor, The Welding Engineer, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

new

Cylinder Catalog

FREE TO YOU

The new Hackney cylinder catalog is now off the press. It's the most complete data file of its kind on modern cylinders for compressed gases, such as oxygen, nitrogen, argon, carbon dioxide, etc.

The catalog describes and illustrates the wide variety of Hackney quality cylinders. A detailed description of the well-known Hackney manufacturing process, plus special engineering data to help you select the right cylinders, makes this catalog your best ordering guide. Use the coupon below to order your free copy.

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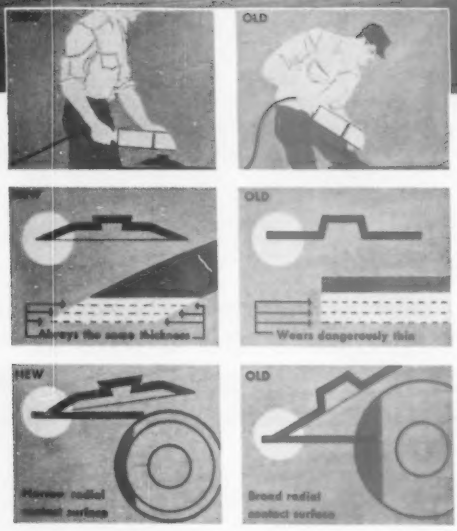
For more facts Circle No. 160 on Welding Info-Aid Card

NOW LONGER WHEEL LIFE
with new U-grade "KOOLIE HAT"

Now there are *two* "Koolie Hat" wheel formulations ... the tremendously successful R-grade for standard grinders and standard grinding jobs . . . and the brand new U-grade for up to 30% longer life on all materials. Designed specially for maximum effectiveness on high-speed, air-driven or electric portable grinders that operate at 5200 r. p. m. or more, Bay State's U-grade "Koolie Hat" wheel gives you the same speed, ease of operation and safety as R-grade . . . *plus* longer life on all materials.



◀ *Easier Operation* Koolie Hat wheel is held at 4° to 5° angle instead of 25° to 30°, requires less pressure, virtually eliminates jitter and bounce. Operator's position is much more relaxed.

◀ *Extra Safety* Koolie Hat shape wears evenly over all three abrasive layers instead of one at a time. Less danger of shattering due to heat cracks or thinning of wheel.

◀ *More uniform speed* Narrow radial contact surface between wheel and work keeps speed high for fast, efficient metal removal without heat build-up.

Get full details on the new U-grade "Koolie Hat" wheel from your Bay State distributor or factory representative *now*. *Better grinding at lower cost . . . that is their business.*

BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

For more facts Circle No. 161 on Welding Info-Aid Card

Your May, 1961

Weld World

As WE went to press, these were the industry's latest developments:

. . Automatic pipe welding in the field is gaining greater attention. Hobart Bros. Co., Troy, Ohio, exhibited an automatic welder for joining large diameter pipe in the field at the AWS show in New York last month. Also, Air Reduction Sales Co. and Linde Co., both of New York City, demonstrated equipment for the same purpose to representatives from the pipe line industry at private showings. More on this next month.

. . A proposed name change to M & T Chemicals, Inc., was rejected by stockholders of Metal & Thermit Corp., New York City, at a recent meeting. M & T sold its thermit welding business several years ago, although it still supplies arc welding electrodes, machines and accessories in addition to its main line of chemicals.

. . Air Products, Inc., Allentown, Pa., and Southern Oxygen Co., Bladensburg, Md., will merge if stockholders give approval. Reports earlier had Southern Oxygen merging with Spencer Chemical Co., Kansas City, Mo. Southern Oxygen, since 1959, has been marketing large amounts of argon produced by Spencer at the latter's Vicksburg, Miss., plant.

. . Political unrest in copper-producing countries is cited as one reason for an expected increase in the metal's price. Domestic demand is another. As WE went to press, copper was selling at 29 cents per pound.

. . Demand for steel is also on the way up. Nearly all mills reported April business bettered March's. And May is expected to surpass April orders.

. . It recently has been disclosed that about 11% of the outstanding shares of Bastian-Blessing Co., Chicago, is owned by Vulcan-Hart Corp., Louisville. As a result, W. M. Smock, president of the latter firm, has been elected chairman of the board of the Chicago company. However, at this time, Vulcan-Hart plans no merger with Bastian-Blessing, nor does it intend to press for outright stock control.

. . Small cases of solid rocket fuel are being Tig welded by Rocketdyne Division of North American Aviation Inc, The highly hazardous operation is performed automatically from controls separated from the weld site by a concrete wall. Properly placed steel heat sink and water cooled chill bar, as well as controlled welding sequence, keep the ammonimum nitrate from ignition temperature.

DATELINE: *Washington*

The nation's economy continues to improve slowly but surely, and there is more hope now that a strong upswing will take place by June than there has been in many months among all groups.

Administration spokesmen continue to underscore the problems connected with getting the economy moving upwards. Secretary of Labor Arthur Goldberg has declared here that 10.5 million new jobs must be created, in one way or another, in the coming 12 months in order to attain the full employment that is the administration's goal.

At the same time, the White House has been trying to promote the idea that business will be given every opportunity to go full steam ahead. The recent tax recommendations sent to Capitol Hill underscore the President's determination not to become known as anti-business.

The various indexes show the economy to be in better health. Total employment hit a new alltime peak in March, as millions trekked back to construction and similar work after the winter snowstorms.

Consumer income was being earned at a rate above $407 billion a year. If it maintains its growth, consumer income will go to new highs this year.

The dark spot on the horizon still continued to be unemployment, which hovered above the five million mark, and probably explains the continued bearishness of consumers in the $7,500-and-less income class. Surveys showed that these consumers (representing three-fourths or more of all consumers) still are hesitant about making new debts. In fact, they paid off installment debts at record rates during the first three months of this year.

* * *

The administration's depression-sized depressed areas bill, providing for $400 million in loans and grants for the first year, has become law and the program will be getting into high gear almost immediately.

Congressmen already are predicting that the program will grow year by year. Opponents charged, during House and Senate debates, that it will be like a drug and that once the nation gets on the "kick" there will be no stopping spending.

"Remember, this $400 million is just the beginning, just for one year," Rep. O. C. Fisher (Dem.— Texas) asserted. "It is conservatively estimated that in another three years the program will cost a billion dollars annually.

"Not since the depression days (of the 30s) has such latitude been extended to a government agency to lend and give away tax money, without regard to actual need to meet and solve a local problem."

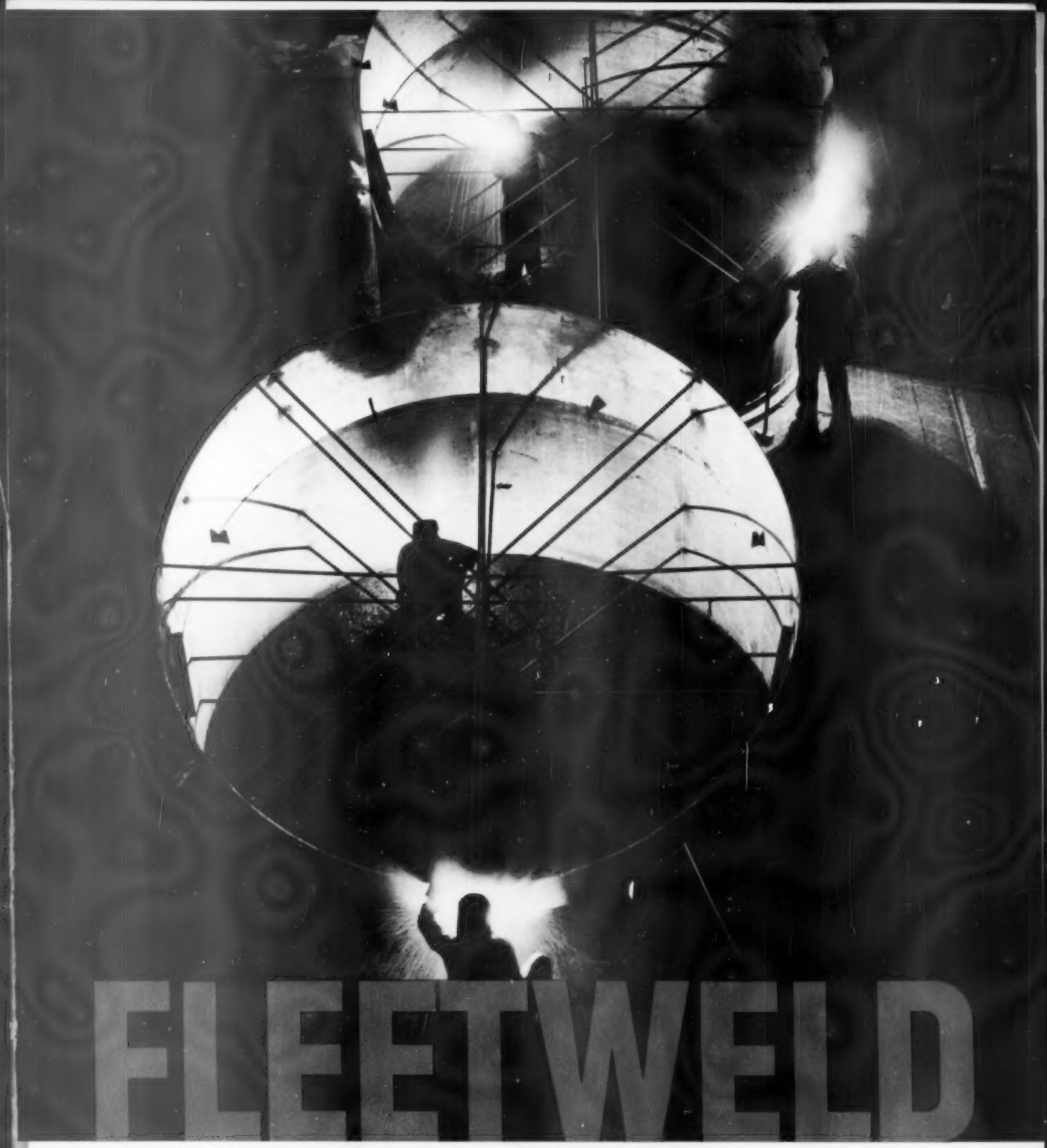
The legislation provides help to all kinds of community groups including "any private or public nonprofit organization representing any redevelopment (depressed) area or part thereof."

* * *

Small Business Administration head John E. Horne reduced the rate of annual interest on SBA loans, to small businesses in economically depressed areas, from 5.5% to 4%. He indicated that shortly this action would be made for all SBA loans. He also lowered the rate on loans to development authorities and Small Business Investment Companies in depressed areas to 4%.

The SBA announced recently that it had licensed the 200th SBIC to come into existence and that, before the end of the year, some 100 more such SBICs would be approved.

For more facts Circle No. 162 on Welding Info-Aid Card →



Several companies make welding electrodes. Many of them are good. But, ask a weldor which one is best for all-position welding, which one welds best on rusty, oily plate, which one delivers best all-around performance. Chances are, he'll say Lincoln Fleetweld 5. Though Fleetweld 5 is the standard of the industry, it's only one of a family of Lincoln electrodes—each one made for a specific mild steel welding task. Read about them all inside.

THESE ARE LINCOLN
FLEETWELD
ELECTRODES ON THE JOB

Customer selected Fleetweld 37 to weld this blower fan housing. Good choice. For, its soft arc and fine ability to weld all position, Fleetweld 37 is widely used on sheet metal work where ease of operation and good appearance are essential. Fleetweld 47 is used in flat or near-flat position.

To get extra tensile strength, Shield-Arc 85 is used on this tubular truss complex. Tube ends chamfered for good metal penetration. Widely used in pressure pipelines and piping due to its high strength. Shield-Arc 85P, similar to 85, makes pinhole-free cover pass welds.

It is true that Fleetweld 5 is probably the most famous electrode in the welding industry. And for this, we are grateful.

But did you know that there are several other Lincoln electrodes—all variations of Fleetweld 5—that have been developed primarily to suit some particular customer need? For instance, when the petroleum industry told us they wanted a smooth-working E6010 rod to give the finest X-ray quality possible on stringer beads, we developed Fleetweld 5P. And for those who use AC machines, we developed Fleetweld 35 which is identical to 5 in every other respect. Fleetweld 180 was expressly developed for AC machines having normally lower open-circuit voltages than industrial machines.

To provide an E7010 version of Fleetweld 5, with proportionately greater tensile strengths, Lincoln engineers came up with Shield-Arc 85. And, Shield-Arc 85P was developed to assure beautiful cover passes without pinholes.

While Fleetweld 5 is the best known E6010 electrode, Fleetweld 7 is the most widely used E6012 electrode for all-position welding. For those customers who wanted a really high-speed E6012 electrode, 7MP was introduced. Coating has an iron powder content which adds to its arc speed and deposition rate.

Some lap and fillet welding is extremely high production work. Here, Fleetweld 72 shines. In fact, all three of these 6012 electrodes—7, 7MP and 72—are excellent for production welding where there is poor fit-up or where work is out-of-position.

Some customers who fabricate much sheet metal work in all positions desired still easier operation and good appearance. For them, we developed Fleetweld 37. And for those who wanted high speeds and deposition rates in flat or near-flat position, there is Fleetweld 47.

So, there they are, the entire Fleetweld family: 5, 5P, 35, 180, Shield-Arc 85 and 85P, Fleetweld 7, 7MP, 72, 37 and 47. Each—born of a specific need—does its job particularly well. Want help selecting the best Fleetweld electrode to suit your problem? See special offer, next page.

LINCOLN ELECTRODES

Here, Fleetweld 7 is used to weld railroad car sections. Picked because of its ability to bridge gaps. Fleetweld 7 and 7MP (a metal-powder rod), are well suited to welding downhill applications, joints with poor fit-up. Perfect for high-speed fillet and lap welding.

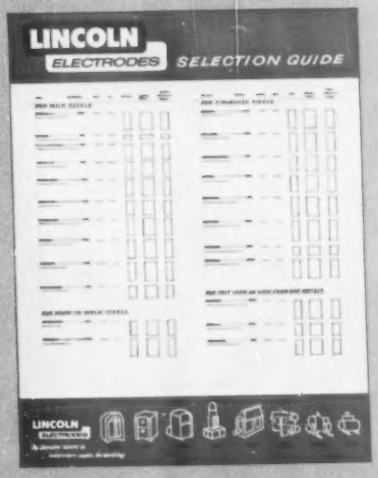
Fleetweld 5 is an industry standard for pipe welding and general maintenance work since it is an all-position electrode. Fleetweld 5P was specially developed to permit smooth pipeline stringer bead welds and deliver X-ray quality superior even to that which you get with Fleetweld 5.

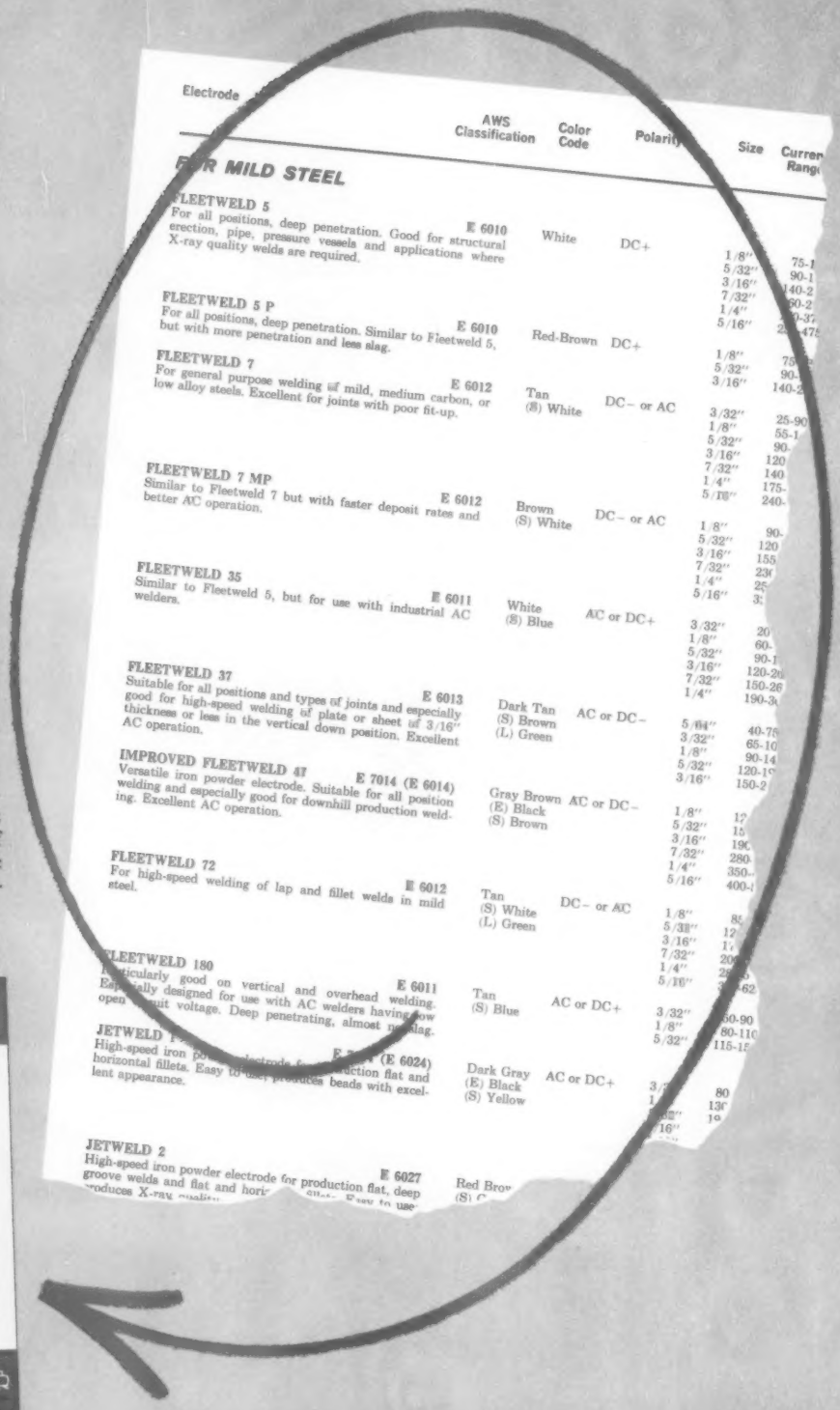
NEW LINCOLN ELECTRODE SELECTION GUIDE AVAILABLE... ABSOLUTELY FREE!

This big, new electrode wall chart lists all Lincoln electrodes made. With it, you can select the exact electrode for your application. What's more, there are columns which list "benchmark" current ranges which will help guide you to the proper setting of your machine for each type of job, each type electrode.

On this chart you'll find sections dealing not only with mild-steel electrodes but hard-to-weld steels, cast iron, low-alloy and high-tensile steel electrodes, etc. In addition to specific electrode recommendations, each is identified by AWS color code markings.

We believe this chart will help you make better electrode selections, save you money. Why not order your copy today? It's free of charge. Write The Lincoln Electric Company, Dept. WW-11, Cleveland 17, Ohio.





Electrode	AWS Classification	Color Code	Polarity	Size	Current Range
FOR MILD STEEL					
FLEETWELD 5 For all positions, deep penetration. Good for structural erection, pipe, pressure vessels and applications where X-ray quality welds are required.	E 6010	White	DC+	1/8" 5/32" 3/16" 7/32" 1/4" 5/16"	75-1 90-1 140-2 190-2 250-3 [illegible]
FLEETWELD 5 P For all positions, deep penetration. Similar to Fleetweld 5, but with more penetration and less slag.	E 6010	Red-Brown	DC+	1/8" 5/32" 3/16"	75 90- 140-2
FLEETWELD 7 For general purpose welding of mild, medium carbon, or low alloy steels. Excellent for joints with poor fit-up.	E 6012	Tan (S) White	DC− or AC	3/32" 1/8" 5/32" 3/16" 7/32" 1/4" 5/16"	25-90 55-1 90- 120 140 175- 240-
FLEETWELD 7 MP Similar to Fleetweld 7 but with faster deposit rates and better AC operation.	E 6012	Brown (S) White	DC− or AC	1/8" 5/32" 3/16" 7/32" 1/4" 5/16"	90- 120 155 230 25 3
FLEETWELD 35 Similar to Fleetweld 5, but for use with industrial AC welders.	E 6011	White (S) Blue	AC or DC+	3/32" 1/8" 5/32" 3/16" 7/32" 1/4"	20 60- 90-1 120-2 150-26 190-3
FLEETWELD 37 Suitable for all positions and types of joints and especially good for high-speed welding of plate or sheet of 3/16" thickness or less in the vertical down position. Excellent AC operation.	E 6013	Dark Tan (S) Brown (L) Green	AC or DC−	5/64" 3/32" 1/8" 5/32" 3/16"	40-75 65-10 90-14 120-19 150-2
IMPROVED FLEETWELD 47 Versatile iron powder electrode. Suitable for all position welding and especially good for downhill production welding. Excellent AC operation.	E 7014 (E 6014)	Gray Brown (E) Black (S) Brown	AC or DC−	1/8" 5/32" 3/16" 7/32" 1/4" 5/16"	12 15 190 280- 350- 400-
FLEETWELD 72 For high-speed welding of lap and fillet welds in mild steel.	E 6012	Tan (S) White (L) Green	DC− or AC	1/8" 5/32" 3/16" 7/32" 1/4" 5/16"	85 12 1 20 25 3
FLEETWELD 180 Particularly good on vertical and overhead welding. Especially designed for use with AC welders having low open circuit voltage. Deep penetrating, almost no slag.	E 6011	Tan (S) Blue	AC or DC+	3/32" 1/8" 5/32"	50-90 80-110 115-15
JETWELD [illegible] High-speed iron powder electrode for production flat and horizontal fillets. Easy to use, produces beads with excellent appearance.	E [illegible] (E 6024)	Dark Gray (E) Black (S) Yellow	AC or DC+	3/ 1/ /16"	80 13 10
JETWELD 2 High-speed iron powder electrode for production flat, deep groove welds and flat and horiz[illegible] produces X-ray quality [illegible] Easy to use	E 6027	Red Brow (S) C			

THE LINCOLN ELECTRIC COMPANY
Cleveland 17, Ohio

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT AND ELECTRODES

LINCOLN ELECTRODES

Between passes

WE safety award

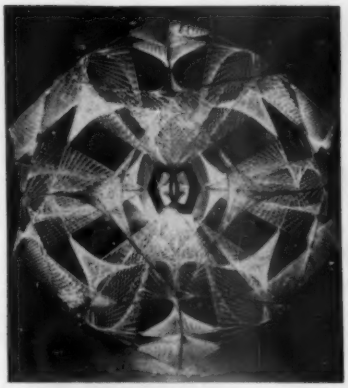
"For exceptional service to safety," WELDING ENGINEER has again earned the National Safety Council's Public Interest Award. The non-competitive award annually honors organizations in the mass communications field. *WE* was among 57 specialized publications to merit this honor.

Established in 1948, the Public Interest Award is presented in recognition of leadership, initiative and originality by the mass media in promotion of accident prevention.

Another *WE* special issue on safety in the welding industry is planned for October of this year.

See the torch?

THE pretty young girl is Barbara Collins. The torch she is wielding is the Prest-O-Matic air-acetylene device being marketed by Navan Products, Inc. The North American Aviation subsidiary has nominated Barbara as "Miss Torch of 1961." We haven't heard of any other challengers, so we assume her election is assured.



body of stars

The 10-ft geometric globe picture above is called "Astrosoma," the Greek word for body of stars. Representing the symmetry of the universe, the sculpture was Tig welded by Professor Roy Gusson of the school of design at North Carolina State College, Raleigh, N. C.

In addition to the many stars on the outer surface, "Astrosoma" contains 120 diamond shapes, 12 pentagonal forms and 20 triangular forms. The sphere weighs 300 lb. Almost a mile of aluminum wire went into the work — fabricated from 2,280 lengths of ¼-in. rod. The 4,080 joints were welded with a Linde Tig torch.

Words worth quoting

". . . The unhappy fact is that conformity is for some an alluring state . . . with security replacing accomplishment as the primary goal. When this happens, instead of the individual becoming victim of pressures within the organization, it is the organization that falls prey to organization men. A comfortable sense of ease may bring solace to an individual, but to the organization itself it brings only a descent to mediocrity."

—Crawford H. Greenewalt, President, E. I. du Pont de Nemours & Co.

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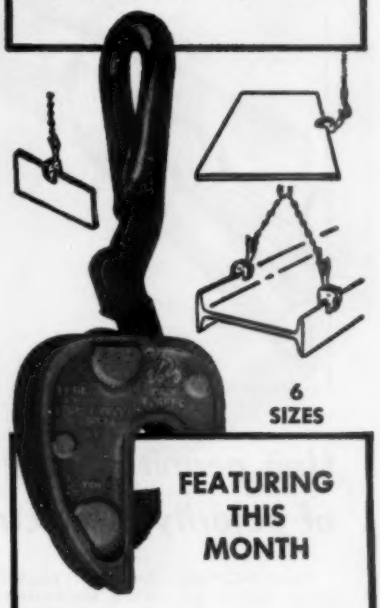
Imitated, but never duplicated, Merrill Lifting Clamps are Drop Forged to give you Safety in Handling and Economy in Operation.



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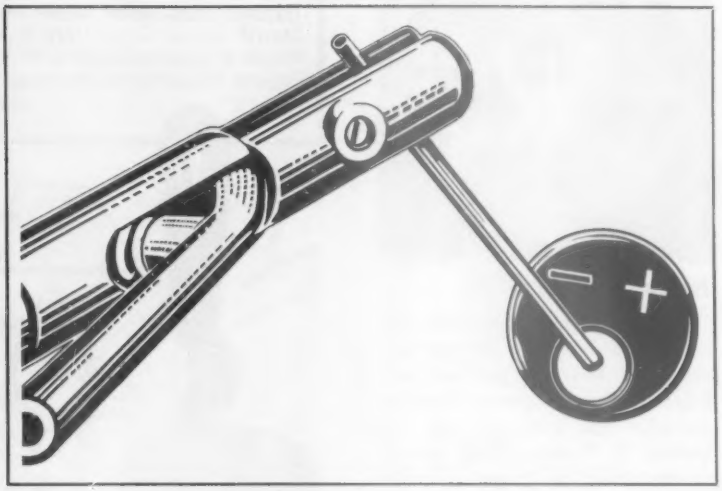
For more information, fold out Welding Info-Aid card on page 97 and circle appropriate numbers as you read.

NEW PRODUCTS for you



Unit permits frequent testing of polarity at electrode holder

Many welding electrodes require either a-c or d-c. When instructions call for d-c, they also state whether positive or negative pole is to be used. The new WKB pole tester is designed for frequent check ups. Two contact rivets are simply placed on the work piece and connected to the welder by the ground cable. Touching the contact plate on the front of the pole tester with the electrode in the welding tongs causes the built-in micro-rectifier to light up a bulb under the + or under the — sign indicating the polarity. For this test, the welding transformer must be set for a welding current of at least 200 amp to insure the bulb will light brightly. **Carl H. P. Pepjung**

Circle No. 1 on Info-Aid Card.

Aluminum etch eliminates spray

Chemclean No. 911-F, a non-sludging aluminum etch, eliminates spray-up of alkali. Can be used in enclosed areas without need for costly exhaust systems, protective masks. **Chemclean Products Corp.**

Circle No. 2 on Info-Aid Card.

Air-cooled gun welds thin gage metal

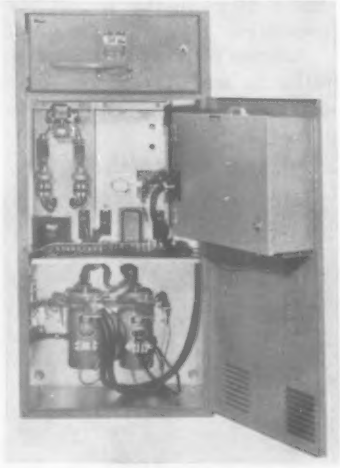
Air-cooled welding gun is designed for gas-shielded metal-arc welding thin gage ferrous metals. Manual Model AH30-A gun has particular value on applications requiring absolute minimum of down time. Appropriate for automotive industry and other mild steel fabrication. Ideal for welding steel with Dip Transfer process. 60-deg goose-neck design permits access to hard-to-reach positions. Uses 0.036-in. and 0.045-in.-diameter steel wires. Rated 300 amp, d-c reverse polarity. **Air Reduction Sales Co.**

Circle No. 3 on Info-Aid Card.

Testing kit measures volts, amps, ohms

Low-cost testing kit includes snap around instrument for measuring volts, amps, ohms. Unit tests voltage on calibrated scale. Six models are available from 0-25 to 0-100 amp; either 0-125/250 or 0-150/600 volts a-c and an ohmmeter scale with a mid-range reading of 25 ohms. **Pyramid Instrument Corp.**

Circle No. 4 on Info-Aid Card.



Welder controls are completely transistorized

Transistorized resistance welder controls use transistor timing, switching circuits to replace conventional thyratron timing tubes and switching relays. Typical applications include automatic conveying systems, machine tool control, numerical positioning. Available with static cycle counter circuits and RC timing circuits. **Square D Co.**

Circle No. 5 on Info-Aid Card.

Alloy is designed for valve stems, seats

Light-weight wear and corrosion-resistant aluminum-silicon-copper extrusions come in two shapes — solid round and hexagon. Ampcoloy 405 is intended for use as valve stems, valve seats. Alloy is non-magnetic, will hot forge and is free machining. **Ampco Metal, Inc.**

Circle No. 6 on Info-Aid Card.

NEW LIFE FOR OLD GOGGLES

Exclusive replacement face pads extend B&L cup goggle life indefinitely

Face pad dirty or worn? Don't throw the goggle away—and don't offend workers by keeping it around. Just snap out the old pad, snap in a new one.

Standardize on these safe, comfortable, durable Bausch & Lomb chippers and welders goggles with the exclusive B&L replaceable face pad. Four snap fasteners are imbedded firmly in the sponge rubber pad. You simply snap new replacements into place in the goggle eyecups. They always fit securely.

You extend your goggle budget because you can buy fewer basic goggles, and "renew" them with replacement pads. You insure worker comfort, encourage cleanliness and care. For details on the complete line, call your supplier, or write: Bausch & Lomb Incorporated, 98717 Lomb Park, Rochester 2, New York.

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Quickly— Easily— Economically does

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- *Folding*
- *Shearing*
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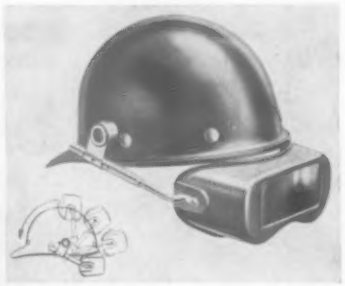


Side arm connects safety cap, goggles

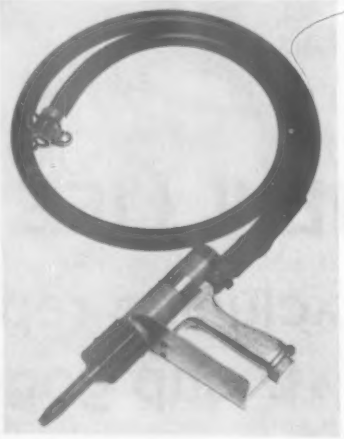
Lightweight side arm attachments combine safety caps, goggles. Attachments permit quick connection, disconnection. F-4055-P-2Q (see cut) may be used when full-time head protection and intermittent eye protection are required. Goggle, when not in use, rests on cap. Side arms are adjustable for full comfort. **The Fibre-Metal Products Co.**

Circle No. 7 on Info-Aid Card.

Hardfacing electrode resists stress gouging

Hardalloy 55 hardfacing electrode is high alloy low hydrogen designed to resist severe wear under high stress conditions. Has good out-of-position characteristics and operates a-c or d-c reverse polarity. Deposits retain hardness at relatively high temperatures, cannot be forged at any temperature and will not respond to heat treatment. Sizes available are ⅛ in., 5/32 in., 3/16 in., and ¼ in. in standard 14-in. lengths. **McKay Co.**

Circle No. 8 on Info-Aid Card.



Air torch designed for fast metal removal

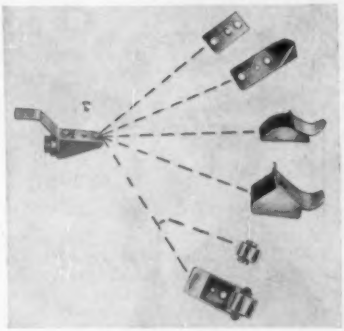
Torch is designed for high production metal removal. Primary purpose is pad washing in foundry cleaning rooms. Torch provides six current contact lines through special alloy spring-action jaws. Stainless steel shield and handle assembly. Available in three sizes: Model R-6 for 3/4-in. electrodes; Model R-5 for 5/8-in. electrodes; Model R-4 for ½-in. electrodes. **Arcair Co.**

Circle No. 9 on Info-Aid Card.

Heating torch needs no blower

Torch is designed for flame heat treating, annealing, soldering, brazing and pre-heating for welding. Needs no blower and uses shop air and any low pressure commercial gas — natural, propane or butane — to produce flame. A small amount of high pressure air at 20 to 100 psi draws equal amount of gas into mixer through primary modified venturi. Venturi entrains additional combustion air and mixes it with gas-rich high-pressure flow. This mixture is delivered to burner nozzle. Available with heat capacity from 4,000 to 3,000,000 BTU/hr. **Bryant-Industrial Products Corp.**

Circle No. 10 on Info-Aid Card.



Lining tip kit cuts plastics welding costs

Kit of stainless steel lining tips cuts cost of complete assortment of tips, according to manufacturer. Kit includes 5/8-in. flat tip, vee tip, a 5/8-in. and 3/4-in. wide strip auto seal tip, a 1-in. wide auto seal tip, and a penton tip (both flat and corner). Tip attachments easily removed and attached by single screw. Basic tip permits preheating under side of plastic strip. **Laramy Products Co.**

Circle No. 11 on Info-Aid Card.

Angle-beam transducers aid ultrasonic detectors

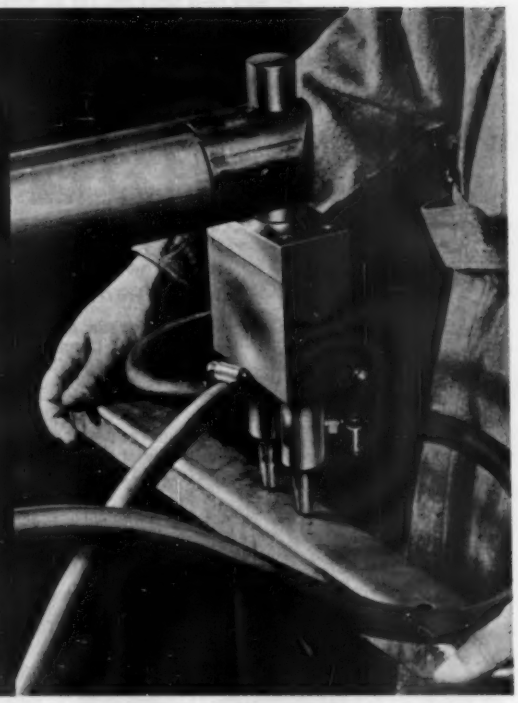
Angle-beam transducers are designed for use with ultrasonic flaw-detection equipment. Transducers can be used where hidden flaws, voids, porosities, or discontinuities must be detected in metals and other hard materials, even when access to only one surface is possible. Angle-beam transducers often detect defects which might be missed by straight beam. **Branson Instruments, Inc.**

Circle No. 12 on Info-Aid Card.

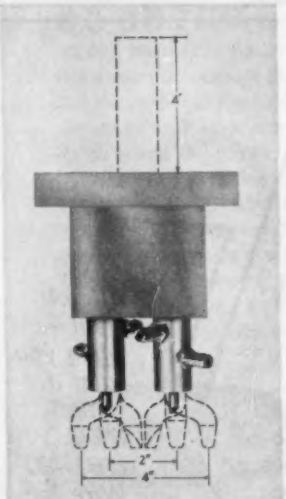
THE TRADEMARKS TO TRUST

AIRCO

Reduce Welding Time up to 50%



Double-Barrelled Tip Holder Makes Two Equal-Pressure Welds

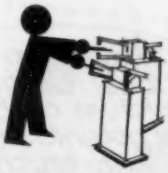


Absolute fidelity of spacing between welds, in a range from 0 to 4", is accomplished by using Tuffaloy bent offset tips as diagramed above.

The TUFFALOY Equa-Press* Dual Holder makes two spot welds at once, and makes them precisely alike. Upon contacting the work piece, the forging pressure is automatically equalized between the two electrodes, regardless of minor variations in work thickness or electrode wear (up to 3/16").

The two tip-holding barrels are sliding pistons, whose movements are controlled by a mechanical equalizing device sealed in the housing. Maximum conductivity is maintained through the copper-alloy working parts, and water coolant fittings are provided.

Models are made for mounting in a welder arm (above) or for bolting to a press welder platen (left).



Doc Tuffy says . . . you'll almost double your output of closely-spaced welds without adding a man, with the TUFFALOY Equa-Press Dual Holder!

There is an AIRCO or TUFFALOY distributor near you. Call him and ask to see the Equa-Press Dual Holder. Ask him too for the TUFFALOY Catalog . . . it makes correct resistance welding electrode specifications easy.

*Airco trademark

AIRCO

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For more facts Circle No. 168 on Welding Info-Aid Card

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Acetylene cylinder valve needs no wrench

O-ring type 600 series acetylene cylinder valve has umbrella-type wheel handle providing smooth operation without valve wrench. Leak-tight stem seal is formed by wiping action of acetylene and acetone compatible rings against easily replaceable bonnet. Will not collect water, permits ready inspection for leakage. Has standard 1⅛-in. wrench flats. Extra long ½-in. ¾-in. and 1-in. NGT inlet connections are available. Standard POL (CGA 511) or Commercial (CGA 301) outlets may be furnished. **RegO Div., The Bastian-Blessing Co.**

Circle No. 13 on Info-Aid Card.

Safety-hat face shield gives splash protection

Face shield worn with safety hat offers maximum under-chin splash and particle protection. Lightweight Mark I shield fits all safety helmets, is 16 in. by 9 in. with 0.040-in.-thick visor. Other sizes can be made. **General Scientific Equipment Co**

Circle No. 14 on Info-Aid Card.

Neoprene-coated sleeve protects cable, hose

Neoprene-coated sleeve protects hose and cable in Tig, Mig welding. Sleeve comes in lengths to fit 9, 12½ and 25-ft. standard cable sizes and has zipper for easy application. **Singer Glove Mfg. Co.**

Circle No. 15 on Info-Aid Card.

Air acetylene torch has automatic trigger

Air acetylene torch flame triggers on or off automatically without external lighting. When safety trigger pressed, battery-operated electronic device lights torch instantly. Releasing trigger shuts off gas, and flame goes out. Gas consumption is reportedly reduced by as much as 80% on stop-and-go jobs. Applications include silver brazing, soldering, tempering light gage metals. **Navan Products, Inc.**

Circle No. 16 on Info-Aid Card.

Temperature-indicating crayons are in 50 F intervals

Temperature-indicating crayons are available for 2,050 F, 2,150 F, 2,250 F, 2,350 F, and 2,450 F. This means temperatures in range from 2,000 F to 2,500 F can now be determined by firm's crayons calibrated for 50 F intervals instead of 100 F intervals. **Tempil Corp.**

Circle No. 17 on Info-Aid Card.

Hardfacing electrode joins dissimilar metals

Hardfacing electrode (Hardalloy 120) joins such dissimilar metals and hard-to-weld steels as austenitic manganese to carbon steel, austenitic manganese to T-1 steel and stainless steels to carbon steel. Deposits have controlled ferrite level of about 12%, provide crack resistance equal to armor welding electrodes. Operates a-c or d-c. **McKay Co.**

Circle No. 18 on Info-Aid Card.

Carton protects mild steel electrodes

Mild steel electrode carton is easier to open and offers added protection to unused electrodes from damage, dirt and moisture. Built-in pull tabs pulled in opposite directions expose entire length of electrode box. Electrodes are cradled in strong separate liner to keep them in good condition when lid replaced. **Hobart Bros. Co.**

Circle No. 19 on Info-Aid Card.

...Low Glare & Low Fuming Characteristics Assure Operator Comfort & Quality Results

GB 88 Flux is recommended for silver brazing steel, brass, copper, stainless steel, monel, inconel, chrome alloys, silver and gold. It is known throughout the industry as the "Production" flux . . . proved and dependable. Because operators recognize an improvement in the quality of their silver brazing jobs when they use GB 88. And they like its glare and low fuming characteristics.

GB 88 Flux is stable in use as well as in storage. It is fully active to 1650°F. Order GB 88 Flux in the size container that suits your needs.

For best results team up GB 88 Flux with GB Silver Brazing Alloys in the shape and size your jobs call for: random coils in all diameters, strips, straight lengths, pre-formed rings and special shapes.

Write for details. A FREE working sample of GB 88 Flux will be supplied promptly on request.

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For more facts Circle No. 171 on Welding Info-Aid Card

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The easy modern way to determine exact working temperatures!

Just mark or stroke the surface with THERMOMELT . . . when it reaches the desired temperature, the mark liquefies. There's no guesswork, no wasted time or material . . . THERMOMELT is the quick, precise way to determine heating temperatures. Accurate to within ±1%.

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the versatile electrodes for field work to JOIN · CUT · SHAPE

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STEELARC® is All-State's specially coated electrode for all mild steel work —flat, vertical, overhead positions. Pass on pass without slag removal. AC or DC. One rod inventory.

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All-State CHAMFER ROD for chamfering, gouging, bevelling, routing and channeling without oxygen or air. Made with special compounded flux coating to protect rod and speed work. AC or DC.

High speed Cutting Electrode slices through cast iron machine housing. This one low-cost electrode cuts any ferrous alloy, lowers inventories.

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QUALITY WITH SERVICE

Threadless-spindle clamps allow greater flexibility

Threadless-spindle welding clamps permit mounting in any position within ¼ in. from arc. Clamps are especially useful when welding rounds to flats. Clamp spindle is solid beryllium copper which eliminates need for special coatings, shields. Spatter will not stick to spindle or body of clamp. Available with vee spindles in 2-in. 4-in., and 6-in. frame sizes and 4-in. by 4-in. and 6-in. by 6-in throat sizes. **United Associates.**

Circle No. 20 on Info-Aid Card.

Magnetic particle-unit checks brazed structures

Recordaflux magnetic particle nondestructive inspection system (first announced in WE last October) can now check brazed metal structures. Film sets up in few minutes after application and "freezes" magnetic particles in position. Particle pattern can be observed on structure inspected, then film stripped off and kept as permanent record. **The Budd Co.**

Circle No. 21 on Info-Aid Card.

Machine cuts solid rounds up to 6-in. diameter

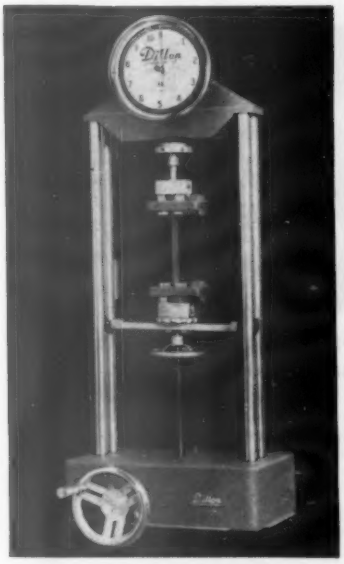
Series 1510 machines with power feed and power oscillation can cut solid rounds to 6-in. diameter in most types of steel alloys at about 2 to 3 seconds per sq in. Unit has been used to test abrasive wheels up to 26-in. diameter with oscillation from 1 to 100 strokes per minute. Stroke length can vary from ½ to 6 in. With proper work holding fixtures, channels to 10 in. are easily cut. Micro inch finish values as low as 32 to 64 are easily obtained. Units are available with 18 in., 20 in., and 26 in. wheels. Similar machine series for wet cutting covers same wheel size range plus ¾-in. diameter. **Wallace Supplies Mfg. Co.**

Circle No. 22 on Info-Aid Card.

A-c arc welders come in 300, 500-amp sizes

Heavy-duty industrial arc welder series for a-c manual and automatic production welding has 60% duty cycle rating. MCM-AC Bumblebee "S" Series comes in 300, 500-amp sizes. Units use movable coil transformer. Magnetic arc blow is eliminated permitting use of larger electrodes and higher heat values. Advantages include 80-volt open circuit, easily changed voltage connections, dual 230/460 voltage. **Air Reduction Sales Co.**

Circle No. 23 on Info-Aid Card.



Unit handles tensile tests as high as 400,000 psi

Model LW extra-wide tester can handle tensile, transverse, compression and sear tests on materials with tensile strength from a few pounds to 400,000 psi. Standard width between uprights has been increased approximately 80% from 8¾ in. to 14½ in. Four daylight openings are available (12 in., 20 in., 30 in., 40 in.) to permit fixture travel in excess of greatest anticipated elongation. **W. C. Dillon & Co., Inc.**

Circle No. 24 on Info-Aid Card.

Manifold sub-base allows ganging of valves

Multiple manifold sub-base is designed for use in manifold mounting of any desired combination of ½-in. single or double solenoid Speed King 4-way plug-in control valves. Designed for application in the "building block" concept of machine design and construction, the sub-base facilitates ganging of up to 10 valves in a single unit. Each sub-base has common inlet, exhaust and conduit ports, with provisions for O-ring seals and connecting bolts to permit end-to-end ganging of individual assemblies. **Bellows-Valvair, Div. of IBEC.**

Circle No. 25 on Info-Aid Card.

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Mark 5F Ultrasonic Flaw Detector

Price for single frequency unit -- $1785.00 plus accessories

Portable, ultrasonic testing equipment provides on-the-spot inspection of metals, ceramics and similar materials. Curtiss-Wright's Mark 5F clearly locates cracks or other internal and surface defects with exceptional close-to-the-surface sensitivity. The Mark 5F is designed to provide optimum performance over a broad range of quality improvements and cost reduction applications in laboratories, shops, or in the field.

- **Portable** — 5¼" wide x 10⅝" high x 18⅛" deep
- **Lightweight** — weighs only 2⅞ lbs.
- **Exceptional Sensitivity** — detects flaws as small as 1/64" diameter
- **High Resolution** — defects of 3/64" diameter can be detected .030" below the surface.
- **Operating Flexibility** — provides test frequencies from .6 to 5.0 megacycles.
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There is no substitute for a Thermo Optically Ground and Polished Filter Plate which is carefully graded and selected to insure you a sharp definition and eliminate fatigue.

The restful soft green shade gives you maximum reduction of eye strain.

Always protect your Thermo Filter Plate with a Sta-Kleer All-Plastic long-life cover lens.

THERMACOTE Company

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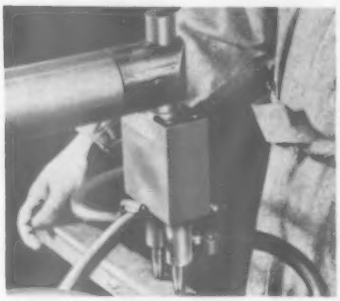
Contour marker adaptor expands layout uses

All four sides of marker can be used in layouts on pipe and structural steel with this contour marker adapter. Unit allows marking up to 30-in. pipe with standard model without having to quarter or halve pipe as in past. Allows marking over nipples, old welds, without having to break wrap so far back on wrapped pipe. Allows marking compound angles in one setting and marking off any portion of tube turns or 90 deg desired. **Contour Marker Co.**

Circle No. 26 on Info-Aid Card.



Spot welding tip holders exert equal pressures

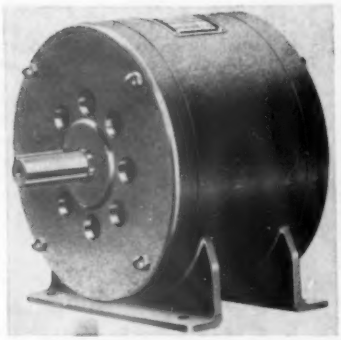
Dual spot welding electrode holder device automatically exerts equal forging pressures through two tip-holding barrels regardless of minor variations in work thickness or electrode wear. Mechanical equalizing mechanism provides maximum conductivity through working parts. Water cooling system incorporated. Offset tips give 0 to 4 in. range of distances between welds. Available for mounting in welder arm or bolting to press welder platen. **Air Reduction Sales Co.**

Circle No. 27 on Info-Aid Card.

Magnetic ground requires no clamps, screws

Aluminum magnetic ground makes positive ground to any shaped object. Alnico magnets produce vise-like grip. Comes on and off in seconds with no awkward clamps, screws or springs needed. Ground remains cool. Pole faces on three sides permit using ground as welding fixture to mold small pieces during welding assembly. **Mange-cast Tool Co., Inc.**

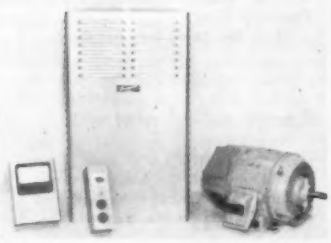
Circle No. 28 on Info-Aid Card.



60 cycle generator has doubled capacity

Sixty-cycle 1,200-rpm generator has been doubled in capacity without increasing size and weight. Unit now delivers 0.5 kva, 3 phase as opposed to former 0.25 kva rating. Increased power output has been obtained without imparing other qualities. Higher ratings are available in both 1,200 and 1,800 rpm generators. Dimensions of present unit are 6½-in. long, 10½-in. wide by 9-in. high. Weight is 50 lb. **Georator Corp**

Circle No. 29 on Info-Aid Card.



Control systems are 5-hp electronic units

New model 5-hp electronic drive systems are designed for 440-volt 60-cycle operation. Systems are supplied complete with 2,400-rpm base speed motor with 60 to 2,400 rpm speed range. Torque rating is of base speed torque throughout entire speed range. Speed regulation is within 2% of set speed over that range from no load to full load. Units provide extremely versatile operation for machine tool and various industrial applications. **Electro-Devices, Inc.**

Circle No. 30 on Info-Aid Card.

Low-cost X-ray paper gives 4-6% sensitivity

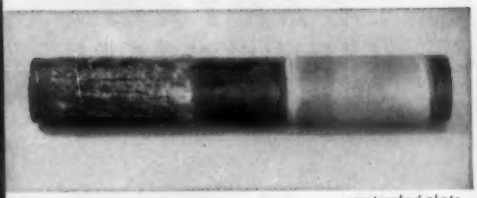
Industrial X-ray paper costs about half as much as standard X-ray film. CAWO paper produces 4 to 6% sensitivity and is reported to be excellent for finding flaws in sharp-contrast items such as metal-to-metal bondings. Paper can be inspected directly without special viewing illuminators because it is glossy print on stiff paper base, not film. Paper is processed in usual way and yields durable print free from fogging. **Picker X-Ray Corp.**

Circle No. 31 on Info-Aid Card.

How flame spraying can pay for itself in your shop in a very short time

ONE EXAMPLE

Hard facing time cut from 4 hours to 25 minutes



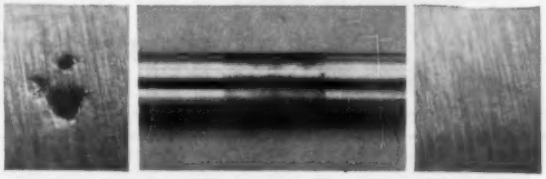
unretouched photo

The two end sections of this shaft have been built up with AMS 4775. Section at left applied by welding – time 4 hours; section at right by flame spraying – time 24 minutes, 45 seconds.

QUESTION: Look at the picture. Which end would you prefer to grind finish?

Here's the whole story. We took a 15" length of 2.5" mild steel shafting and undercut two 5" sections .050" on the radius. We then sent the shaft to a nationally-known job shop with instructions to apply AMS 4775 on the left-hand section, sufficient to finish at 2.5". Weight of welded-on alloy was 17 9/16 ounces – time spent by one of their top men – 4 hours (including preparation).

Then we blasted the second section with steel grit and flame sprayed it with AMS 4775 in powder form (ThermoSpray Powder 15E). The coating was then torch-fused. Weight of deposited alloy – 11 5/16 ounces; surface preparation, set-up and pre-heat – 12 minutes; spray time – 5.5 minutes; fusing time – 7.25 minutes.



Unretouched photo, in center, shows finish-ground shaft. Insets, magnified about 50X, show pits in welded section (left) and no pits in flame sprayed section at right.

We then sent the shaft out to a grinding shop with instructions to clean up at 2.500" plus. The flame-sprayed section cleaned up at 2.510" but welded section still showed pits when grinding was stopped at 2.477" Rockwell of welded end Rc-61, sprayed end Rc-60.

Pump plunger being flame sprayed with METCO ThermoSpray® Powder Gun

These flame-sprayed coatings are solid, homogeneous; usually superior to those applied by other methods. You can apply them at high speed, with lower material and finishing costs. In addition to AMS 4775, a number of other powders – including tungsten carbides – are available for various service requirements; all may be fused–some used as sprayed for certain service requirements.

For further information on this high-speed, money-saving, hard-facing process, phone, write or wire.

METCO INC.
FORMERLY METALLIZING ENGINEERING CO., INC.
Flame Spray Equipment and Supplies

1127 Prospect Ave., Westbury, L. I., N.Y. Telephone: Edgewood 4-1300 Cable: METCO
In Great Britain: METCO., Ltd., Chobham-near-Woking, England

FREE BULLETIN

FREE BULLETIN: Send off the coupon for this and other useful information which shows how flame spraying pays for itself–in a very short time. No obligation, of course.

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Please send me information on hard-facing by flame spraying.

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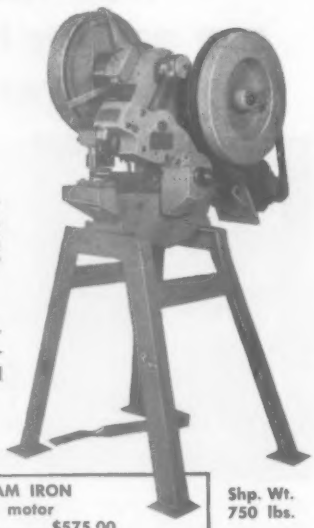
For more facts Circle No. 176 on Welding Info-Aid Card

For more facts Circle No. 178 on Welding Info-Aid Card

Large and Small Fabricators of steel and ornamental iron swear by it ...

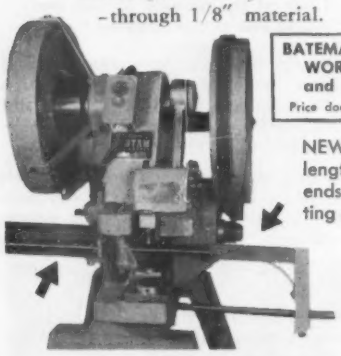
BATEMAN BANTAM IRON WORKER



The Bantam cuts and punches fast and clean . . . no grinding necessary. It's versatile, and saves time and labor! Cuts 2″ x 2″ x 1/4″ angle and 1/4″ x 4″ flats.

Punches 1/2″ hole through 1/4″ material. Operates by hand or foot, uses 3/4 hp motor (1750) rpm., powered with flywheel and drive gear.

The Coper will cope 1-1/4″ -through 1/8″ material.



BATEMAN BANTAM IRON WORKER, with motor and stand $575.00
Price does not include Blades, Punches or dies.

Shp. Wt. 750 lbs.

NEW ACCESSORIES: Gauge for cutting to length, Guide for Flat Bars for cutting on ends, and Angle Iron Trimming Guide, for cutting at a 45 degree. Write for details.

WRITE TODAY for complete information and name of nearest distributor

Bateman Foundry & Machine

MINERAL WELLS, TEXAS

The best names in Welding

are found on

WELDING DISTRIBUTOR CATALOGS

designed and compiled by

Catalog Div., Welding Engineer Publications

Box 28 **Morton Grove, Ill.**

X-ray films

Industrial X-ray film, Type AA and Type M, ready pack in roll form and 16mm, 35mm and 70mm widths.

The 35mm rolls are used for nondestructive testing of long pneumatic and hydrostatic tubes for aircraft construction. The 70mm film is used for testing long, welded sections of thin steel and aluminum. *Eastman Kodak Co.*

Circle No. 32 on Info-Aid Card.

Thyratron, diode tubes

Thyratron and diode tubes predict tube failure 300 hours ahead of time. Tubes change color from normal blue to neon red before failure. Tubes available in 2.5 and 6.4 rating — pin or lug base. *Reliance Electric and Engineering Co.*

Circle No. 33 on Info-Aid Card.

Paint stripper

Alkaline paint stripper for zinc-clad steels strips paint without attacking zinc. Stripper provides operation economy with long tank life and simple control. Mixture of strongly alkaline salts used at 8 to 16 ounces per gal of water at 180 F to 200 F and stripper in mild steel tank strips quickly and completely without further treatment. *Chemclean Products Corp.*

Circle No. 34 on Info-Aid Card.

Large rolled plates

Rolled plates, available in large-size series, meet RWAA Classes II and III as well as other high-conductivity applications. Produced in two resistance welding alloys, thicknesses include ⅜ in., ½ in., ⅝ in., and 1¾ in. Maximum widths range from 48 in. to 60 in. Maximum lengths range from 96 in. to 156 in. Stated thicknesses include 1/16 in. per side finish allowance. *Ampco Metal, Inc.*

Circle No. 35 on Info-Aid Card.

Sanding roll

Air-inflated sanding roll for portable coated-abrasive operations has 3-in. diameter and is 6-in. long. Unit will sand large areas without gouging. Rubber drum is replaceable without special tools. Roll can be used with nearly any horizontal grinder having ⅝ by 11-in. threaded spindle and speed of 4,500 rpm or less. *Nu-Matic Grinders Inc.*

Circle No. 36 on Info-Aid Card.

Gas flow recorder

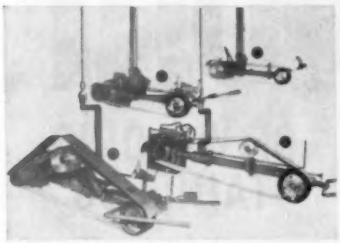
Dual gas flow recorder records 20 to 200-psi input pressures on 10-in. 8-hr or 24-hr. chart. Recording all standand flow ranges, 15 ipm to 3,000 cfh, recorder can be used as two individual recorders on same chart. It can also be used with two different gases passing through mixing chamber and mixture can be controlled by independent control valves to any mixture desired. *Elematic Equipment Corp.*

Circle No. 37 on Info-Aid Card.

Safety goggles

Monospecs are available with any of five styles of sideshields. One size bridge constructed goggle can adjust to 90 to 95% of employes automatically. Two lens sizes, 46mm and 48mm, fit most bridge sizes and shapes. Sideshields come in clear flesh or green plastic, perforated or unperforated, and plastic bound 20 mesh wire screen. *Willson Products Division*

Circle No. 38 on Info-Aid Card.



Abrasive grinders

Line of 20 standard model abrasive belt swing frame grinders is available from 2 hp up with air or spring tensioning. Belt sizes 2-in. through 6-in. wide and 72-in. through 132-in. long. *Grinding and Polishing Machinery Corp.*

Circle No. 39 on Info-Aid Card.

Air filter reservoir

Reservoir for compressed air filters and lubricators is metal with visible indicator of fluid level. Indicator uses pyrex tube as column gage. Level of contents is visible a full 230 deg so it can be seen from behind. When installed on air line, sight gage can be rotated to face any direction. All-metal reservoir is die cast of zinc alloy and pyrex tube is protected by thin metal strip running full length in front of it. Sight gage may be purchased separately. *Wilkerson Corp.*

Circle No. 40 on Info-Aid Card.

Engine-driven welders

Engine-driven 225-amp a-c/d-c welder can handle Mig, Tig and stick electrode welding. Power source supplies from 15 to 265 amps d-c and 25 to 320 amp a-c. Two d-c diesel welders are designed for field use; one is 300 and 400-amp rated powered by 4-cylinder 4-cycle injection-type diesel engine; third welder rated at 250 amp and using 4-cycle 3-cylinder direct-injection-type diesel engine is available as both d-c welder and a-c power plant or solely as d-c welder. *Air Reduction Sales Co.*

Circle No. 41 on Info-Aid Card.

Weld nuts

Weld nuts are designed for blind applications in bolting sheet metal products where vibration would shake ordinary nuts loose or where thin gages are required. Nuts are electrically welded into place by standard projection welder. Circular shoulder, or pilot, positions nut and four projections on nut face. Nuts are particularly effective where insufficient room for use of wrench or where thin gage sheet metal prohibits use of tapped holes or self-tapping screws. *Republic Steel Corp.*

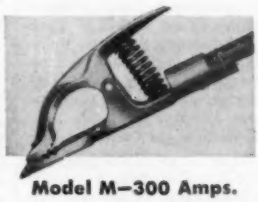
Circle No. 42 on Info-Aid Card.

you do... with these NEW

SuperGrip®

GROUND CLAMPS

Model L—500 Amps.



Model M—300 Amps.

Model S—200 Amps.

Quick and "handy" grounding speeds up the welding job and a positive connection saves welding power to produce more welding work per day. These new *SuperGrip* GROUND CLAMPS were designed by the industry's most experienced manufacturer of welding and safety equipment.

check these outstanding features:

EXTENDED LOWER LIP for easy clamping with quick "under and on" motion.

BALL POINT SET SCREW of "man size" diameter grips cable tightly for full cross-section connection.

CABLE SUPPORT LIP offers added wrap area to minimize strand breakage.

POWERFUL COMPRESSION of spring gives maximum "bite"... with spring fully insulated from grips.

BROAD, FLAT BASE JAW and heavy teeth offer large contact area for positive connection.

ASK YOUR WELDING DISTRIBUTOR *or write for Bulletin No. T2-R*

The FIBRE-METAL Products Company | CHESTER PENNA

In CANADA: Fibre-Metal (Canada) Limited, Toronto

NOW!

CHOOSE ONE OF 4 WAYS TO REPAIR GALVANIZING . . .

- coating
- stick
- powder
- bar

DRYGALV The "wonder tonic" for all maintenance work, galvanizing repairs. Requires no heat. Gives steel permanent protection against rust and corrosion through its cathodic action. Coating contains 95% metallic zinc. Easy to apply by brush or spray on all ferrous metals — over traces of rust, partially painted surfaces, clean metal, welded joints, galvanized surfaces. Dries in 15-30 minutes. One gallon protects 400 square feet of metal. Meets U. S. Government Specifications for repair of Galvanizing.

AMCO GALVANIZING COMPOUND IN STICK FORM, No. 322

convenient pocket size compound for repairing damaged galvanizing. Easily and quickly applied to surfaces not suitable for powder. Simply heat area required and brush with AMCO stick. Leaves a continuous, uniform, bright and protective coating. Meets U. S. Government specifications for repair of galvanizing.

AMCO GALVANIZING POWDER, No. 321

Makes fast, permanent repairs of all damaged galvanized surfaces. Forms free flowing paste with water, applied by brush. Heat and wipe with cloth. Cleans the surface of all rust and foreign matter. Meets U. S. Government specifications for repair of galvanizing.

AMCO GALVANIZING BAR, No. 3017

In convenient, handy form — ¾" square, 14" long; weighs only 5 ounces. Surface to be repaired needs no cleaning — simply heat the surface, rub AMCO bar over area, then wire brush. No applicable government specs.

Available from your local distributor *or write*

AMERICAN SOLDER & FLUX COMPANY

1903 W. Willard St., Philadelphia 40, Pa.

Circle No. 180 on Info-Aid Card

Air cylinders

Stainless steel air cylinders have 1 1/16-in. bore. Stroke lengths through 3 in. Wall thickness has been increased 50%. Long life is result of smooth mirror finish plus piston "U" cups. *Bimba Mfg. Co.*

Circle No. 43 on Info-Aid Card.

Ignition tube

Six E, 900-amp d-c coaxial cathode connection ignitron is designed for resistance welders. NL-1064 is metal, water-cooled, mercury pool. Tube can be used with a-c control applications. Tube has rating equivalent to 2,400-amp magnetic contactor. Internal cooling coil increases cooling surface to give long life and arc-back-free operation. *National Electronics, Inc.*

Circle No. 44 on Info-Aid Card.

Diamond wheel dresser

Block diamond wheel dresser has 150 octahedrons set in tungsten powders for tough gripping action around stones. Face measures ¼ in. by ⅝ in. and is 7/16-in. deep. Alternate layers of 21 and 22 diamonds in face for dressing wheel. Diamonds act similar to more than 20 needles cleaning metal particles from grinding wheel. Unit can be purchased in straight or 15-deg shank. Designed for dressing wheels from 12-in. to 48-in. diameter. *Lazzara Co.*

Circle No. 45 on Info-Aid Card.

Inert-gas rectifier

Inert-gas rectifier tube is 6.4 amp d-c. Tube, designated NL-660L/7786, available with lug base or bracket-type four-pin base. Other ratings are: filament volts, 2.5; filament current, 21 amp; and peak anode current of 80 amp. *National Electronics, Inc.*

Circle No. 46 on Info-Aid Card.

Vinyl coating

Vinyl coating eliminates marring and scratching of polished, embossed or coated metals during fabrication, storage and shipping. Coating provides necessary protection to preserve surface of polished or prefinished sheet metal. Coating protects metal surfaces from effects of oil and grease and from discoloration or etching by corrosive chemicals. Can be applied by brushing or reverse roll, spray, dip, flow and roll coating. *B. F. Goodrich Chemical Co.*

Circle No. 47 on Info-Aid Card.

Flash welder

Model F-3 flash welder is designed for joining mitered corners of extruded aluminum members. Welder features bi-directional clamping system, welding dies that nest in extrusion, and adjustable components that allow up to one degree of angular variation to compensate for parts shrinkage. Design of pneumatic system and circuitry permits different clamping sequences. Vertical clamps and welding dies are machined to conform to geometry of extruded member. *Thomson Electric Welder Co.*

Circle No. 48 on Info-Aid Card.

Circle No. 181 on Info-Aid Card

TRIM COST OF WELDING STAINLESS

Remember: only Airco makes everything for Aircomatic®, Heliwelding, and stick electrode welding of stainless. Don't decide until you let Airco compare all 3 welding processes for your application.

AIRCO AIR REDUCTION SALES COMPANY

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NEW RODS
NEW LOW PRICES
NEW "TUFF-TOP" MOLY-NICKEL Hard Facing Fuse-Well No. 16 Rods

- NICKEL-COPPER Fast-Flow Fuse-Well No. 66 Rods
- No. 22 Dual Purpose Cast Iron Electrodes

WRITE FOR SAMPLES, NEW LOW PRICES TODAY!

Weld Rod Division

CHICAGO HARDWARE FOUNDRY CO.

North Chicago, Illinois

FUSE WELL

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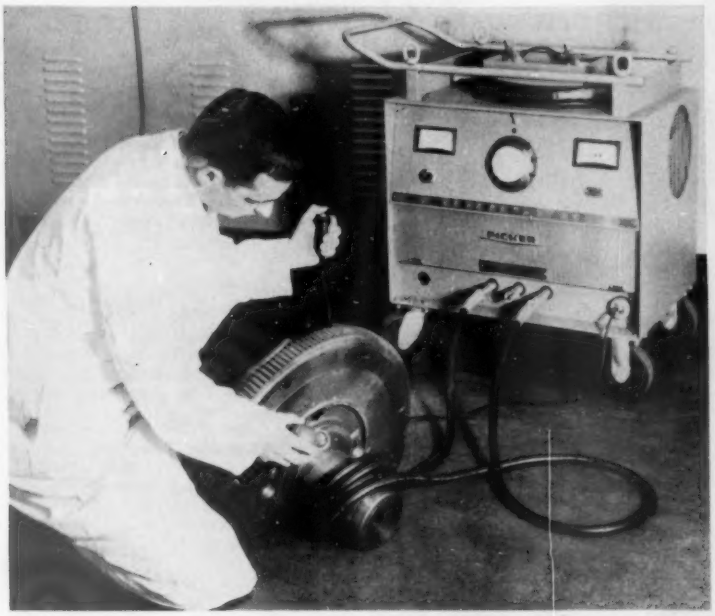

Mobile inspection unit

Lightweight mobile 3,000 amp magnetic particle unit is designed for industrial inspection of metal products. Mobile Ferroscope unit operates on a-c or half-wave d-c and is effective in detecting surface and sub-surface flaws on parts too large for inspection on stationary wet horizontal units. Unit weighs 600 lb, measures 23 by 37½ in., rolls on solid rubber casters. Unit can find defects such as thermal cracks, hot tears and shrinkage in castings, thermal and crater cracks and lack of fusion or penetration in welds, and fatigue cracks, lamination and forging flaws in a variety of applications. **Picker X-Ray Corp.**

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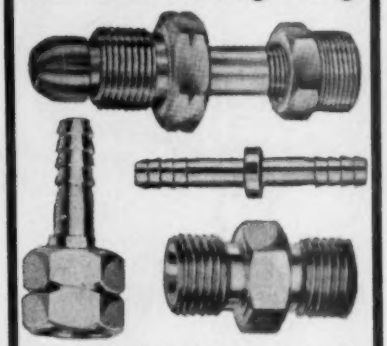
ANYWAY YOU LOOK AT IT, IT'S OXO

For HIGH QUALITY and LOW COST Welding Fittings



Write for FREE 20 Page Catalog Describing this Most Complete Fitting Line.

OXO

Welding Equipment Co.

Cedar and Oak Streets

New Lenox, Illinois

PROGRESSIVE IS FIRST WITH THE FINEST IN "JOB-ENGINEERED" RESISTANCE WELDING EQUIPMENT

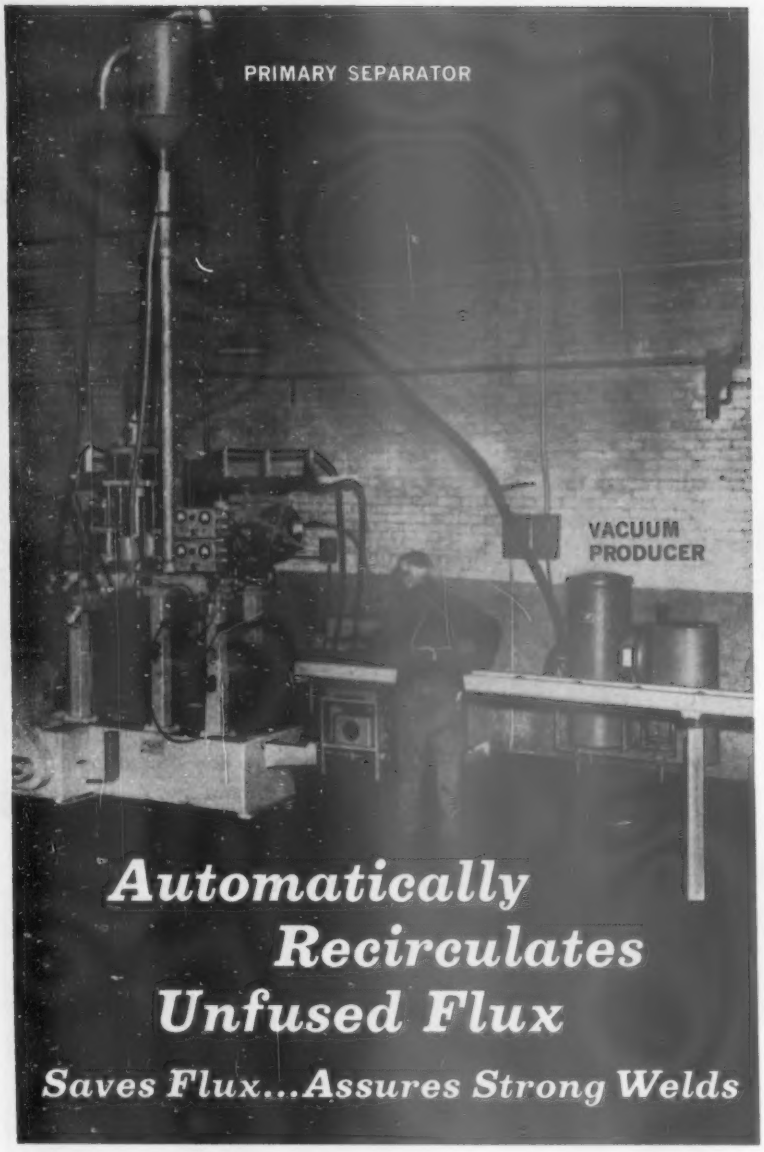
Over twenty-five years of outstanding experience in the welding field makes Progressive your best bet for the finest resistance welding equipment and fixtures. A dependable part of the welding picture in almost every important manufacturing plant here and abroad, Progressive equipment has proved its quality and superiority right on the job.

Our engineers will gladly assist in the solution of your production problems.

Shown here are a few examples of Progressive's many types of equipment for every welding requirement.

PROGRESSIVE WELDER & MACHINE CO.

915 Oakland, Pontiac, Mich.



This Berkeley Continuous Seam Welder forms commercial angles into square welded tube at the rate of 80 inches per minute. The 5-horsepower Invincible Welding Flux Recovery System keeps pace by supplying a continuous flow of flux to the high speed welder.

The Invincible automatically recovers all unfused material. It removes powder and returns dust-free flux to the work in a non-stop operation. The results: Increased production. Absence of rejects. Strong, clean welds. And material savings that paid for the system in a few months.

With 14 standard models (1½ to 7½ H.P.), Invincible offers a system for virtually any submerged arc welding operation. Learn why Invincibles are the choice of welding fixture manufacturers — and users. Write us for a free survey of your operations. And . . .

Send for Flux Recovery Equipment Folder

INVINCIBLE

vacuum cleaner manufacturing co. • Dover, Ohio

Flow alarm

Flow alarm provides protection against failure of gas flow to a process or heat-treating furnace. Alarm, operating in conjunction with firm's flow meter, utilizes photo-electric principle. Alarm can be adapted to all meters ranging from 0-10 cfh through 0-30,000 cfh. Relay contacts in control handle 10 amp at 110 volts. *Waukee Engineering Co.*

Circle No. 50 on Info-Aid Card.

Gageless regulators

Multi-stage gageless regulators for oxygen, acetylene and propane are UL approved. Regulators feature 1-in. metallic non-flammable diaphragm in safety stage and have first and second-stage safety valves. High-pressure cylinder content indicator shows full, 3/4, 1/2, 1/4 and empty. Inlet stem is protected to prevent damage to stem seat. Calibrated working pressures are deeply embossed on bonnet for accurate reading and regulation. *British Oxygen Canada, Ltd.*

Circle No. 51 on Info-Aid Card.

Strip welder

Automatic tube mill strip welder shears, welds and planishes on work cycle of less than 25 seconds. Mash seam welding is used on special welder to achieve high speed joining, high quality and high reliability. Welder accommodates cold rolled steel stock ranging from 0.040 to 0.060-in. thick and ⅜ to 7-in. wide. Welding power supplied by 30 kva transformer mounted on traveling "C" frame. A 10-hp hydraulic unit delivers 15,000-lb force to planishing rolls and is power source for strip clamping and shearing. *National Electric Welding Machines Co.*

Circle No. 52 on Info-Aid Card.

Aftercoolers

Aftercooler is built for capacities of 50 to 120 cfm of air. Unit comes in lengths from 40 3/8 in. to 95 1/4 in. overall and cooling chamber is 4 1/2-in. diameter. Unit features non-corrosive copper coil through which valve-regulated cooling waters flow. Manufacturer guarantees unit will cool compressed air to within 85% of cooling water temperature when installed, operated and maintained in accordance with instructions. *Jas. A. Murphy & Co.*

Circle No. 53 on Info-Aid Card.

Welding rods

Steel welding rods will develop 67 to 68 Rockwell C hardness when applied to cutting and wearing edges of high-speed tools and dies by Tig welding. Weld deposit is reported to be excellent when applied to tools for machining cast iron, heat treated alloys and other abrasive properties. No. 4 rods in 36-in. lengths are available in 1/16-in., 3/32-in., ⅛-in., 5/32-in., and 3/16-in. diameters. *Welding Equipment & Supply Co.*

Circle No. 54 on Info-Aid Card.

For more facts Circle No. 185 on Welding Info-Aid Card

For more facts Circle No. 186 on Welding Info-Aid Card →

LINDE COMPANY
UNION CARBIDE

SIGMATIC

NEW ALL-IN-ONE "MIG" WELDING EQUIPMENT

Welding equipment is designed, developed and refined, but eventually it must be redesigned. LINDE'S new SIGMATIC line of "Mig" welding equipment is a product of this evolution . . . plus LINDE'S vast experience with more inert-gas and consumable-electrode processes than any other company in the world. The SIGMATIC line is the most-versatile semi-automatic equipment available anywhere—one machine for:

- . . . all types of "Mig" welding—spray arc, short arc and spot welding
- . . . in all welding positions—vertical, overhead or downhand
- . . . with all shielding gases—argon, helium, CO_2, or their mixtures
- . . . and all wires—hard or soft, solid or tube
- . . . on all weldable metals—carbon steel, stainless, aluminum, magnesium, titanium
- . . . on all thicknesses—sheet metal and up

See next page for details.

SIGMATIC

One SIGMATIC machine for... spray arc... short arc... spot welding

Spray arc, short arc, spot welding... never before combined in a single piece of equipment. SCC-8 control incorporates special spot-welding circuitry, featuring a directly-calibrated, precision weld timer and an independently-adjustable, "non-stick" timer. Converts from spot to continuous fusion welding at the flick of a switch. SEH-2 heavy-duty wire-feed unit—largest, most-rugged unit available today—permits positive feed of all "Mig" wire types, metals and diameters. The SIGMATIC line contains five basic units, designed with interchangeable parts permitting more than 50 combinations tailor-made to individual specifications. Available in cart-, sled- or bench-type units.

Unique controls are vastly simplified. All components are visible and accessible. Adjustments can be made with a screw driver. Only heavy-duty industrial-type parts are used throughout each unit to insure dependable, long-life performance with minimum maintenance. Top-quality parts—"Square D" pneumatic timers, Mallory electrolytic condensers, Cutler-Hammer switches, Potter & Brumfield relays, Electrons, Inc. thyratron tubes. The SIGMATIC line is unquestionably a major welding advance—with one rugged, durable machine, you can do any type of "Mig" welding in any position on any thickness of any metal. For more information or a live demonstration, call your nearest Linde office.

"Linde," "Sigmatic" and "Union Carbide" are registered trade marks of Union Carbide Corporation

LINDE COMPANY

UNION CARBIDE

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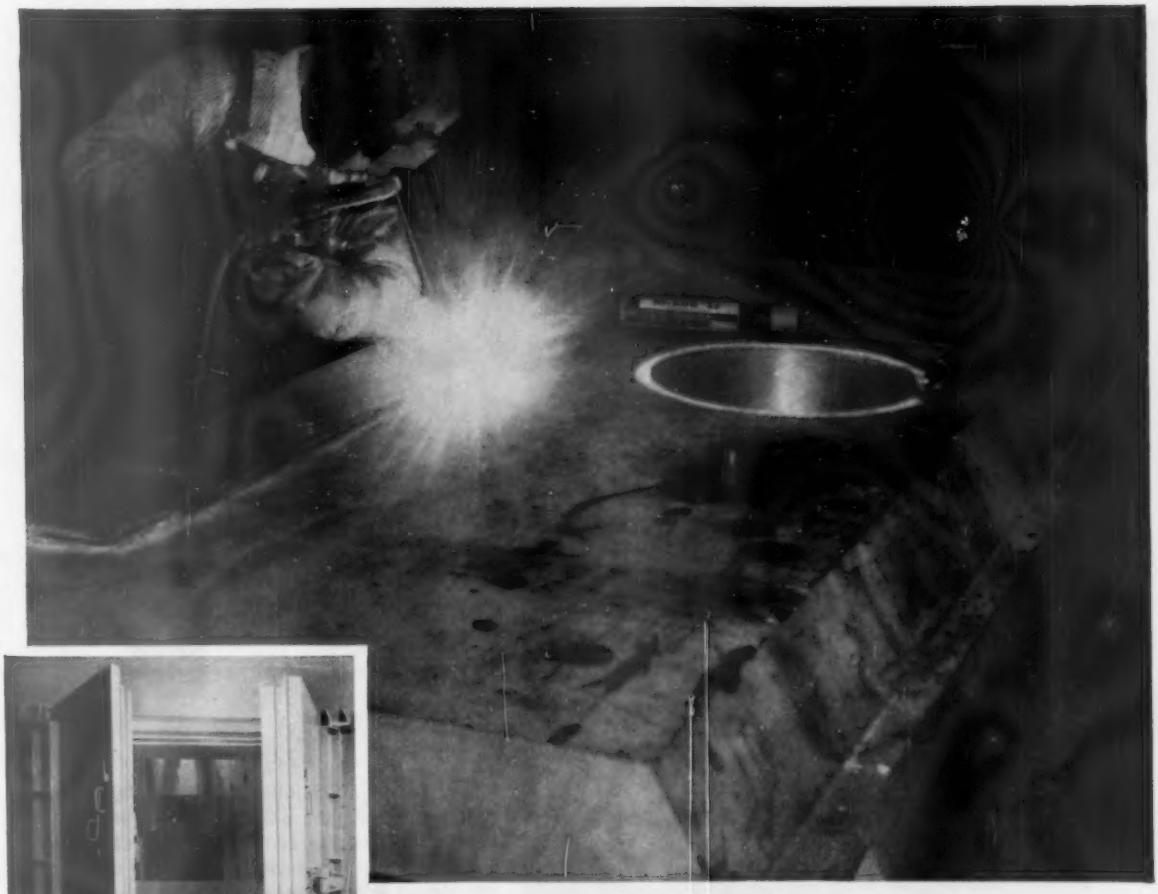


Pre-heat impossible!

Yet Ni-Rod "55" produces welds in grey iron heavy sections that are strong, sound, ductile

This was the job: construct four radiation-shielding doors and frames for the National Reactor Testing Station in Idaho – each panel 8 feet high, 5 feet wide. Total weight for door and frame assembly: 86,000 pounds.

The H. K. Ferguson Co. wanted the Olympic Welding Co., Seattle, to build the entire assembly of *grey cast iron* – with no bolted connections.

These were the welding problems: heavy welds were required to join the cast iron frame sections (approximately 7 inches thick) to a special hinge structure. Any substantial pre-heat was ruled out because of the large size of the parts to be joined.

This was the solution: Ni-Rod "55"* Electrode. This electrode was chosen after experimentation with various other electrodes. Only Ni-Rod "55" produced welds that were strong, sound, and ductile. *Welds that passed magnetic particle inspection!*

Over 500 pounds of Ni-Rod "55" went into this job. All finished welds proved sound, free of defect.

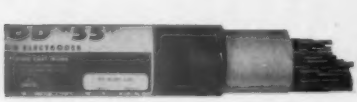
For your cast iron welding jobs, you'll find Ni-Rod* and Ni-Rod "55" Electrodes can be quite helpful. For permanent repairs in cast iron parts—to salvage defective castings—to build up worn or undersized areas—and to join cast irons to other metals.

Even weldors with limited experience can get good results with these easy-to-handle electrodes. And no special work preparation is actually needed. You'll find, too, that Ni-Rod and Ni-Rod "55" will give you machinable welds, smooth bead contour, excellent "wash," and easy slag removal.

Write for "A Handy Guide to Welding Cast Irons." A postcard will do it.

*Inco trademark

HUNTINGTON ALLOY PRODUCTS DIVISION
The International Nickel Company, Inc.
Huntington 17, West Virginia



INCO

WELDING PRODUCTS

ELECTRODES • WIRES • FLUXES

FINEST THING FOR

MIG WELDING

(using *any* shielding gas)

. . . is a MILLER CP-2 VS!

CP-2 VS

The Miller CP-5 illustrated below is a high output, constant potential d-c welder especially equipped to handle MIG welding applications on heavy plates and structures. This welder features five continuous adjustment voltage ranges operating from 500 amperes at 40 volts to 50 amperes at 10 volts. Slope control has fourteen positions. Convenient horizontal design is only 27½" high.

CP-5

Swift and solid success of Miller's variable slope d-c constant potential 300 ampere welder for all MIG work led to the development of the 200 ampere version shown here. Offered especially for use with recently introduced 200 ampere air-cooled guns having self-contained spools of wire, the CP-2 VS delivers:

Continuous voltage and slope adjustment • Current as low as 15 amps at 10 volts • A constant potential d-c source for heavy MIG work • Slope control with infinite continuous adjustment.

Information available upon request relating to 200 ampere CP-2 VS, 300 ampere CP-3 VS or 500 ampere horizontal model, the CP-5.

miller ELECTRIC MANUFACTURING COMPANY • APPLETON • WISCONSIN

EXPORT OFFICE: 3 West 57th Street, New York 19, N.Y. • Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

Too many too often

"AREN'T THERE TOO MANY welding shows?" We hear this question asked frequently by engineers who like to attend them and by manufacturers who feel obliged to exhibit at them.

In view of the schedule established for March, April and May, with six national meetings involving welding and four with shows, it sounds like a reasonable query.

Most trade groups seem to be getting convention and meeting happy — and we believe the welding groups are the happiest of all.

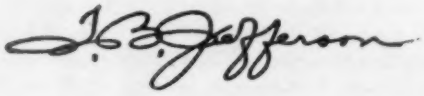
Except for July and August (and there are even some exceptions there) hardly a week goes by that we do not have an opportunity to attend one or more national, regional or local welding meetings. Papers are always presented and usually exhibits are included.

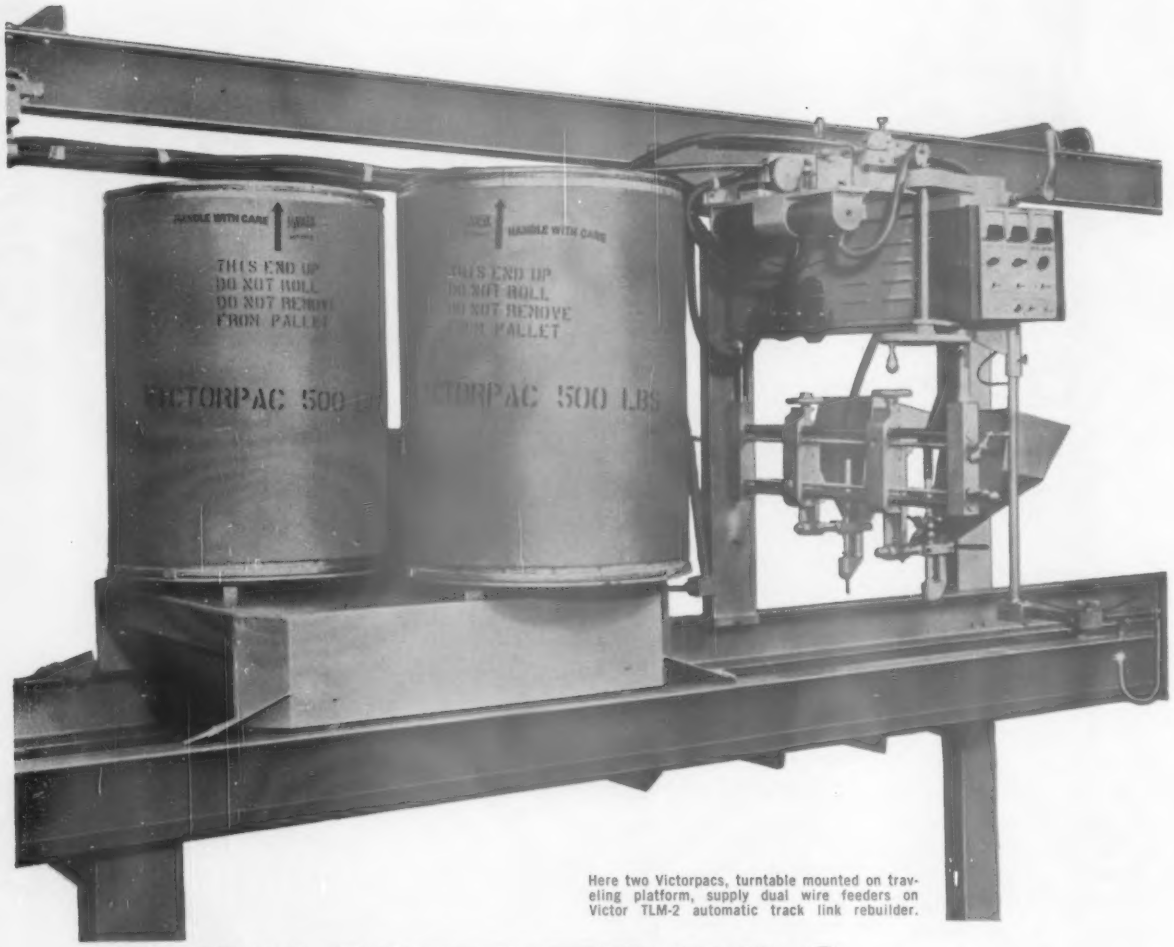
As a publication dedicated to the welding field, we used to attempt coverage of them all, but we have had to give up the idea. There is just not enough time if we are to publish a magazine too.

This lack of time apparently kept all but little more than 500 non-Californians from attending last year's Los Angeles Welding Show. At this writing, the New York show is still several days away, but indications are that nationwide attendance will be disappointing.

Again, it is a good guess that attendance will primarily be regional. Is this because the national show is held too frequently? Would it be better to hold a regional show every year with a national show every two or five years? The Oil Show with its five year frequency is "the greatest industrial show on earth."

With the national welding show on a less frequent basis the manufacturers would really have something new to talk about — and we all would have more time to do our work.





Here two Victorpacs, turntable mounted on traveling platform, supply dual wire feeders on Victor TLM-2 automatic track link rebuilder.

NEW VICTORPAC

Reduces track rebuilding costs 2 ways

Saves you 3c per pound and up to 2 hours changing coils

Now you can get Victor high quality, uniformity guaranteed VA4X, VA5X, and VA7X continuous-coil hardfacing wire in 500-lb. Victorpac containers. You pay 3¢ less per pound than for standard 100-lb. layer wound rolls. You also eliminate four coil changes and gain up to 2 hours productive time per 500-lb. Victorpac. Also available, 200-lb. Victorpac at savings of 2¢ per lb.

Works with all automatic rebuilders

Simple, low-cost turntable enables you to use Victorpac hardfacing wire with track link rebuilders, roller and idler rebuilders, grouser bar welders, or any other automatic welder. Victorpacs are easy to handle and store, keep wire clean and dry.

Why not take the easy Victorpac way to increased productivity and lower wire costs? Order from your Victor dealer now. He's your one-stop source for hardfacing wire, rebuilding equipment, welding apparatus.

H-78

VICTOR for hardfacing

Profitable dealerships open; inquire now!

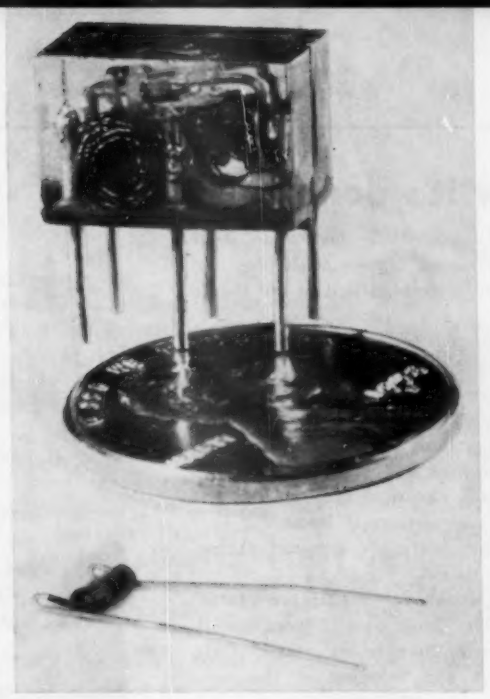
VICTOR EQUIPMENT COMPANY

Alloy Rod & Metal Division
13808 E. Imperial Highway, Norwalk, California
Wakita, Oklahoma

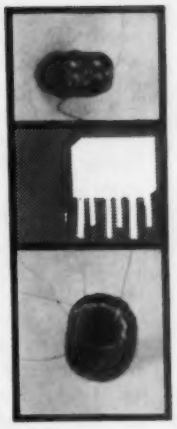
For more facts Circle No. 189 on Welding Info-Aid Card

Weld-wax— a new method joins diodes

by **A. W. Sweet**
Light Military Electronics Dept.
General Electric Co.



miniaturization



FABRICATION OF MINIATURE encapsulated electronic assemblies presents some delicate joining problems which only welding can adequately solve.

To produce a core-diode logic unit (a basic component of GE's Variable Increment Computer) a high-speed production method was developed, making use of both welding and a wax-injection technique.

The electronic unit consists of a miniature tape-wound bobbin core, a special diode and a resistor-choke or impedance element. Approximately 100 of these units are dip-soldered to a plug-in 9 by 4½ by 1 in. module, several hundred of which are used in the computer.

In order to meet the requirements of extreme reliability, smallness, ruggedness and economy, five basic production steps were formulated:

1. — **Weld all connections for increased reliability.**
2. — **Minimize the number of electrical interconnections by utilizing diode leads for terminations.**
3. — **Encapsulate the entire unit, thus, eliminating a molded base with pin inserts.**
4. — **Use wax molds to be melted off during resin cure.**
5. — **Use a resin with a double temperature cure cycle for better dielectric and physical properties.**

Soldering the internal connections was not advisable since the unit would later be dip-soldered to a printed wire board, and the short pin terminations would conduct the soldering heat to melt the seven internal connections.

Welding, on the other hand, would give a sound metallurgical bond with a better mechanical and electrical joint. In addition, the welded joints do not deteriorate with age, cyclic stress and temperature cycling to the degree that soldered joints do.

Elimination of soldering also eliminates the need for flux (and its subse-

CORE-diode logic unit components in the three-panel illustration above are (top) choke, (middle) actual size diode outline, and (bottom) toroid.

How it's done

To FABRICATE the core-diode logic unit, four 0.020-in.-diameter tinned copper wire pins and the diode leads are assembled first in the fixture (figure 1).

Diode leads formed in an H-shape, act as two external connections, minimizing the number of internal connections for optimum reliability. The fixture clamps and deforms pins and leads, which extend one-half their length into a cavity later injected with wax.

This insures good electrical ground connection for welding and deformed leads are better anchored in the potting compound during subsequent encapsulation.

The toroid and choke (figure 2) are placed in body contact. The 3-mil wire is then wound around the pins with three to six wraps, starting at the bottom and winding to the top. Stripped coil interconnection taps are twisted together and then capacitor discharge arc welded.

Wires are first twisted and their ends cut evenly. Grounded tweezers grasp the wires and a small arc is drawn between the ends and the electrode.

A molten ball rolls back around both wires forming an excellent joint (see figure 7). Power consists of 1,200 MFD (microfarads) at 40 volts with 2.5 ohms resistance.

The 3-mil-diameter coil taps are then Tig welded to the 20-mil-diameter pin terminations (figure 3). Welding power supply was manufactured by Miller Electric Mfg. Co.; the Tig torch by Argopen Co.

The 20-mil-diameter tungsten electrodes gave good results at 3 to 8 amp, d-c straight polarity. Argon flow was 6 cfh. The higher amperage was required to weld the 3-mil copper wire to the 20-mil leads because of the H-shape.

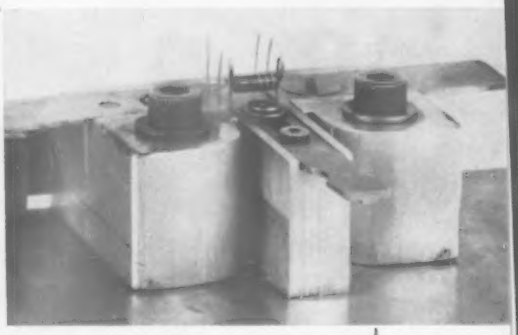
The insert in figure 3 shows a macro-photograph of one of the welds. Any stress transmitted by the wire is not transmitted directly to the welded joint but is relieved by the helical winding of the copper wire around the pin.

Wax is then injected into the cavity below the assembled unit. Figure 4 shows the fixture opened and the unit supported by the wax. Figure 5 shows the wax collar, which is assembled to the wax base, and the completed unit.

The unit is then encapsulated with a double temperature cure cycle resin, which jells during the first and lower temperature cure cycle. The jelled unit can then support itself during the second and higher temperature cure cycle. The wax melts in this cycle.

The final operation involves sanding the unit's top to required height and marking with the required identification.

1



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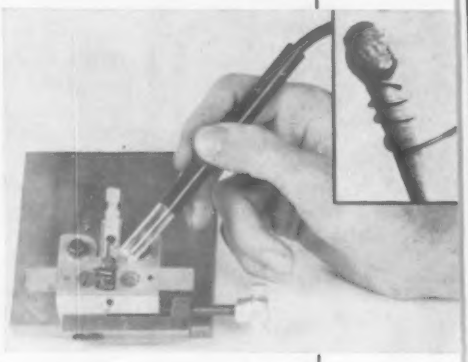

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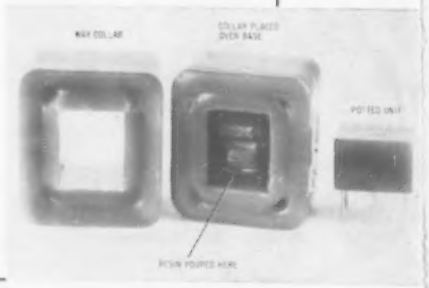


Weld-wax — a new method . . .

quent removal), decreases the need for surface cleanliness, and lessens any possible corrosion problems. The final advantage: welding produces a lighter-weight joint.

Although the welded joint is sound and strong, ductility may be low with some metal combinations, resulting in relatively brittle joints. However, encapsulation makes the package rugged and prevents joint cleavage.

The diode is less susceptible to heat damage from welding since welding's short time factor lessens total heat input. Tests have shown no detrimental effects due to welding close to the diode body. And as mentioned above, ductility is not a major consideration since the unit is completely encapsulated.

Because the welding heat would damage or char any resin base, a molded base with pin inserts could not be used. Even heat sinks could not solve this problem. Molding the diode leads into the base as terminations also would be difficult, if not impossible, because the heat and pressure of molding could damage the diode.

Far from being a disadvantage, the elimination of the resin base decreased the unit's size and weight. In addition, using only resin cured at one time provided a more rugged, compatible and moisture-resistant packaging medium.

As a result of all these considerations, a metal fixture was designed to hold the unit together for assembly, welding and potting. Thus, the fixture serves as a common welding lead to the joints and as a mold cavity for injection of the wax.

The wax holds the unit together when it is removed from the welding fixture and, with a wax collar, serves as the potting mold. Choice of a two-temperature-cure cycle resin provided better insulation, moisture and mechanical properties, and sustained a high temperature environment.

A wax was chosen that would support the assembly during the lower-temperature resin jell cycle. During the higher-temperature cure cycle, the wax mold is melted off and the wax is reused. For added protection during storage, a protective coating of wax remains on the unit.

Using this wax-injection technique, mold removal and mold cleaning (as required in conventional methods) were eliminated, as well as investment in permanent or non-durable type molds.

Various welding processes, designs and materials were investigated and evaluated before the two joining processes, three metal combinations and two material diameters were chosen. (*For details of the diode's fabrication, see the boxed material.*)

The diode was fabricated by Tig welding five AWG No. 40 copper wires (0.0031 in. diameter) to 0.020-in.-diameter tinned copper terminations. One AWG No. 40 Advance wire was also Tig welded to a 0.020-in.-diameter tinned copper termination. The seventh joint was made by capacitor discharge arc welding the No. 40 Advance wire to the No. 40 copper wire.

Tig welding was chosen since it was more reliable, economical and less critical to operate than resistance welding. The Tig welds were also easier to control and inspect.

Figure 6 shows a micro photograph of a typical Tig welded joint. The inserts show enlargements of one side of the same weld. Figure 7 is a macro photograph of coil interconnection taps between toroid and choke made by capacitor discharge arc welding.

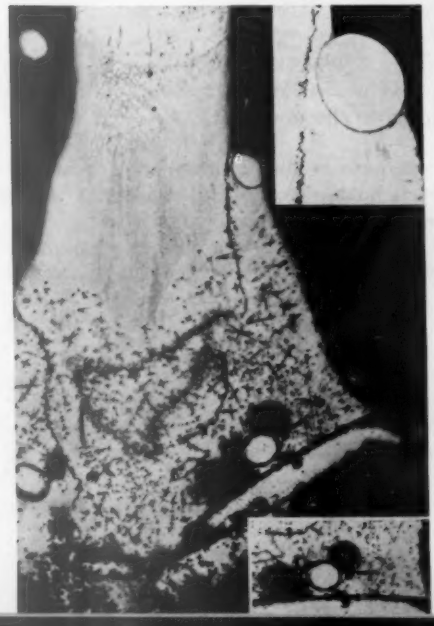
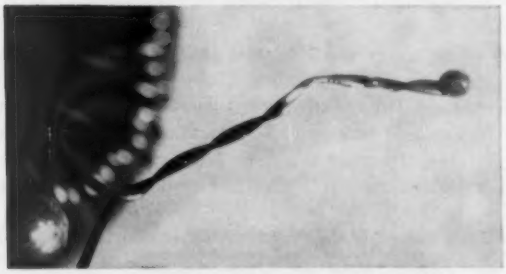
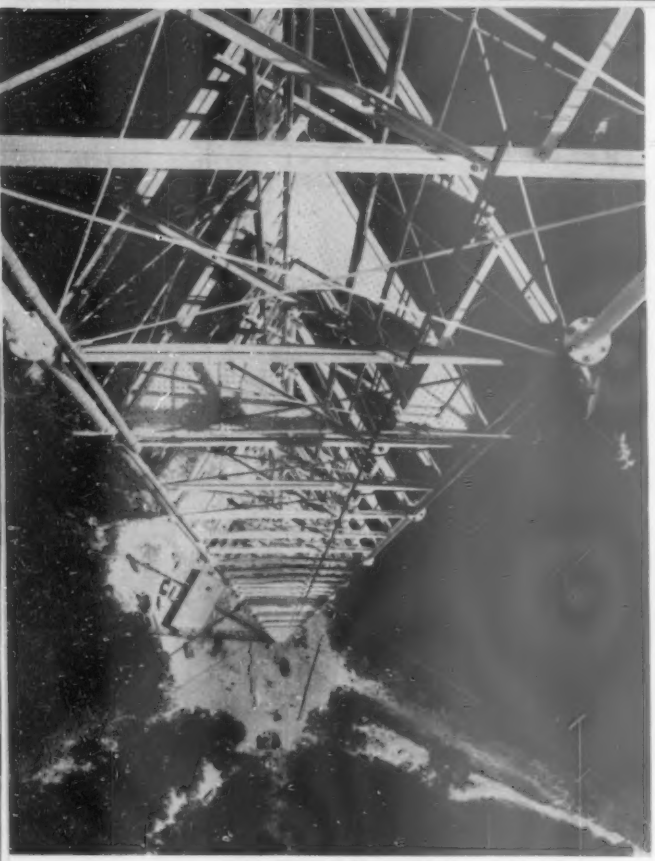


FIG 6 — *Micro photograph of typical Tig welded joint. Inserts are enlargements of right side*

FIG. 7 — *Macro photograph of coil interconnection taps between toroid and choke made by capacitor discharge welding.*





CONSTRUCTION WELDING

by Elda Jones and K. H. Zeigler*

WELDED construction was deemed the most effective and economical fabrication method for this 1,676-ft television tower by the designers.

In the Show-Me state

World's tallest structure . . . design said "weld it"

THE WORLD'S TALLEST man-made structure is a new, welded television transmitting tower located at Cape Girardeau, Mo.

The triangular, 1,676 ft tower, measuring 10 ft on each side, was put in operation last fall by station KFVS-TV. It is 204 ft taller than the Empire State Building and 692 ft taller than the Eiffel Tower.

The tower was designed and fabricated by Dresser-Ideco Co., Columbus, Ohio. The firm his found that welded construction is generally the most effective and economical fabrication method for this type of structure.

Approximately 75% of the tower fabrication work was done by welding. All parts were jig-fitted in the shop and welded into components, which were then shipped to the tower site.

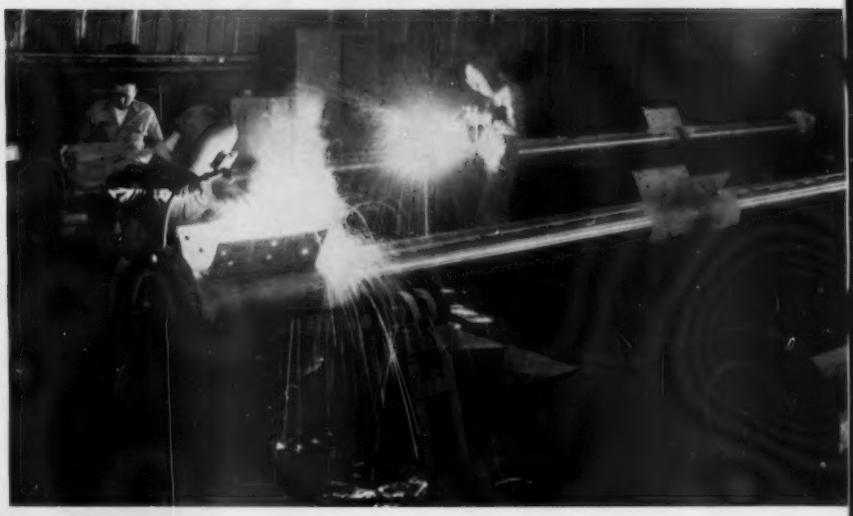
Field welding was limited to the antenna attachment which holds the 8-ton, 81-ft antenna. Since this tower-antenna attachment joint is subjected to repeated stresses, welding was the only answer.

The tower's solid-round steel legs are spaced 10 ft apart and have a maximum diameter of 7¼ in. The legs are fabricated in 30-ft lengths with round splice plates welded at each end.

For the horizontal girts and diagonal bracing, gussett plates were welded at various points along the leg. Solid steel rounds varying in diameter from ¾ to 1⅜ in. were used as diagonal bracing, with their ends welded to steel tie plates.

Other welded tower components include the ele-

*Mr. Jones and Mr. Zeigler are, respectively, plant engineer for Dresser-Ideco Co., and regional manager, welding products division, Metal and Thermit Corp.



FLANGE plates are welded to 30-ft leg sections (right). Three of these sections, plus supporting members, comprise one unit. Diagonal rods (below) used for cross-bracing are fitted with splice plates before being shipped to tower site.

vator, guy pull-offs, all anchor material, lighting brackets and platforms.

With the exception of the tower legs (which are Man-Ten steel), all components were made from A-7 steel. Manual metal-arc welding was used throughout the project with E6014, E6024, E7016 and E7018 electrodes supplied by Metal & Thermit Corp., Rahway, N. J

Electrode diameters ranged from 5/32 to 7/32 in. Iron powder electrodes predominated, amounting to about three-quarters of the total used. Both a-c rectifier and motor generator welders were used in the shop for straight and reverse polarity welding.

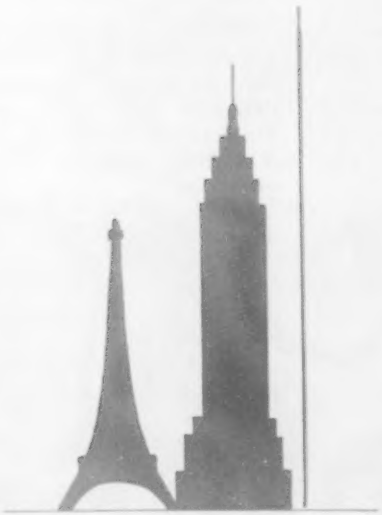
In fabricating the wide variety of tower sections, weldors utilized different techniques as the welding problems changed. Butt, fillet and vee-type welds were used with single and multiple passes.

All welds were visually inspected while those in vital areas were given draw and die checks.

The tower was designed for a wind load of 50 lb per sq ft on flat surfaces and 33.3 lb per sq ft on round surfaces. This is equivalent to a wind velocity of 109 miles per hour with a gust factor of 1.25.

The foundation was designed for a vertical thrust load of 1,836,000 lb, a horizontal shear load of 23,700 lb and an overturning moment load of 892,000 ft lb. Maximum soil pressure under the above load is 8,000 lb per sq ft.

Round members were used wherever possible because the wind load on such a member is only two-thirds that on a flat member.



TELEVISION tower is 204 ft taller than the Empire State Building and 692 ft taller than the Eiffel Tower, making it the world's tallest man-made structure.

HEAVY launch-cell door weighing 80 tons is lifted and moved onto concrete pad. Blast-proof doors measure 32½ ft wide, 23 ft high and 36¾ in. deep.

CONSTRUCTION WELDING

1,280 tons of blast-proof doors for missile site!

by **Howard E. Jackson**

FABRICATING A MISSILE launching facility for the U. S. Corps of Engineers involved a great deal of welding.

Largest part of the job in this complicated combination of structural steel and hydraulics was the fabrication of the cell doors and their supporting structures.

Yuba Consolidated Industries, Inc., had to build 16 blast-proof launch-cell doors. Each 80-ton door measured 32½ ft wide, 23 ft high (with channel), and 36¾ in. deep.

In addition to the doors, the firm assembled and welded the associated parts, including the supporting structures on which the doors were hinged, the door frames, exhaust tunnel doors, cell and tunnel door latches, and operating mechanisms.

Rolled beam sections for the door were not available on the west coast, and because of uncertain delivery times from the east, the firm decided to fabricate its own beams from available plate. Costs were comparable for rolled beam or fabricated plate sections.

A production line was set up in Yuba's Richmond, Calif., plant where each door was assembled from 31 beams, each 36½-in. deep with 12-in. flanges, but of different plate thicknesses: 1¼-in.-thick flanges on ⅞-in.-thick web plates; and 1-in.-thick flanges on ⅝-in.-thick web plates.

A ½-in. gap was maintained between the flanges of each beam and then semiautomatically submerged-arc welded for 2 ft at the top and 1 ft 5 in. at the bottom.

The remainder of the opening between the flanges was then filled with a sealant material which adhered to the steel to make the door watertight. The sealant was extruded into the groove and left to cure for 48 to 72 hours.

Back-up plates to keep the sealant from falling through the gap were hand plug-welded to the flanges whenever needed.

The beams were then shipped by truck to Benicia, Calif., for final assembly and welding of the doors. A 125-ton, stiff-leg derrick was installed, and a 40-ft wide by 100-ft long concrete pad was built to facilitate handling and welding of the final door assembly.

The derrick was positioned on the waterfront so it could cover the work area as well as set the completed doors on the barges, which carried them to the Oakland Army docks for shipment overseas.

Four doors were assembled simultaneously. The beams were tied together by a ¾-in. bottom plate and a 1-in. border or boundary plate. (The bottom plate was also fabricated by automatic submerged-arc welding from two pieces since a one-piece plate was not available.)

These bottom plates were then welded to the beam using a double-vee joint with one, two or

ASSEMBLED doors are covered with 11-gage sheet metal panels held down by welded studs. Automatic and semiautomatic submerged-arc welding equipment can be seen on and around doors.

three passes, depending on fit-up. Border plates were then joined to the door using a single-vee joint, one pass, with the bevel on the border plate.

In this welding operation and elsewhere, as with the ¼-in. back-up plates, manual metal-arc welding was used on the root pass to prevent burn-through when semiautomatic welding. In turn, semiautomatic welding was used for the same reason before fully-automatic submerged-arc welding was begun.

After the sealant was set, the doors were tested under water pressure. If there were any leaks, water was drained out, sealant removed and the groove refilled. Then the doors were re-tested.

When the doors were completed, they were covered with 11-gage sheet metal panels held down by welded studs. For shipping, the doors were placed face down on 6 by 8 in. supporting timbers and with 4 by 8 in. shoring on the back side.

Holding the entire package together was a 2-in. wide, 0.05-in.-thick metal strap running parallel to the door.

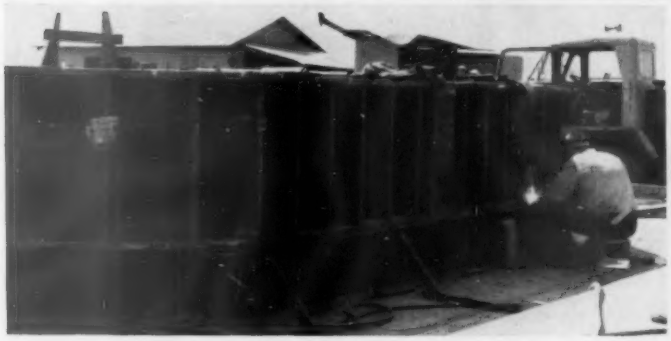
A second major welding job was fabrication of the door's supporting structure from 36-in., wide-flange beams with hinge sections welded on top. Additional stop and reinforcing studs were welded to the back.

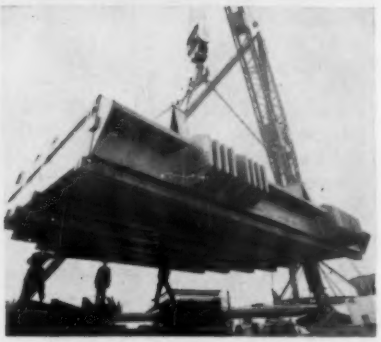
When completed, the supporting structure weighs 17 tons. The material used is A242 high tensile steel with common inforcing rebars.

The 1-ft-long rebars (210 of them) were welded to the backs of the supporting structures, arranged in three rows with 5 in. spacing. The middle row was staggered to make it accessible for metal-arc welding.

Other welding included the main door latches and many minor welding jobs, such as mounting brackets for cylinder assemblies which operate the doors.

STIFF-leg derrick (right) was installed to help assemble doors and load them on barges; concrete pad was also built to aid assembly. Latch plates (below, left) are manual metal-arc welded to cell door. One missile launching-cell door (below, right) is lifted by derrick for loading on barge and ultimate overseas shipment.





CONSTRUCTION WELDING

Old standby—A-7 steel—used in all-welded building frame

by **E. E. Hanks**
American Institute of Steel Construction

WELDING AND CUTTING are lending a Charlotte, N. C., bank a hand in erecting its new building.

Currently under construction is the North Carolina National Bank Building, a 16-story structure with an all welded steel frame and a column-free main tower.

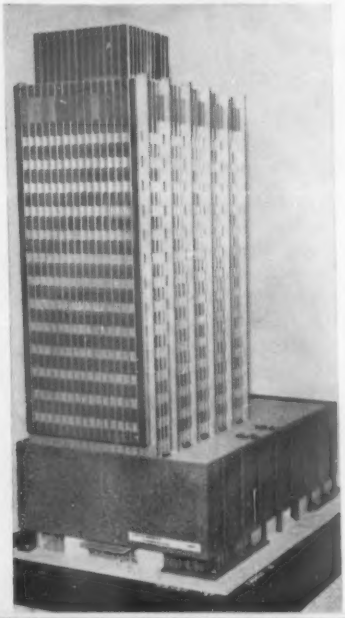
The building will be constructed in two phases. Two adjoining towers with a two-story penthouse will be erected first by Bristol Steel and Iron Works, Inc., Bristol, Va. When this is completed, the bank will move in from its present 12-story building next door.

This, in turn, will be removed to make room for four floors to be built adjoining the tower section on one side and to the rear.

One tower will house bank personnel and the leased offices, the other, elevators and stairs.

Girders bridge the entire width of the main tower with a clear span of 55 ft, providing a column-free interior of about 8,000 sq ft at each floor. Greater efficiency and economy result from this design since partitions may be placed and office space rearranged as desired by tenants.

The main tower columns are built-up welded wide-flange beams (369, 300 and 280 lb). Wing and cover plates of varying sizes are submerged-arc welded to the beam flanges.



HEAVIEST column section (above) measures 47-ft long and weighs 25 tons. Two wing plates and a cover plate were automatic submerged-arc welded to the wide flange. Completed building (left) as shown in model will have four floors adjoining the tower.

All the steel used was ASTM A-7. A special rolling at the mill produced beams with a flange width of 17½ in. and a thickness of 1 11/16 in. The web was 1½ in. thick and 36¾ in. deep.

The heaviest column, 47-ft long and weighing 25 tons (1,064 lb per lineal foot), was fabricated using the 36-in.-wide flange,

369-lb beam as the core and welding two wing plates and a cover plate to the flange.

The wing plates measured 30 in. wide by 2¾ in. thick while the cover plate was 20 by 2¾ in.

Before welding the wing plates to the flange, the flange edges were beveled 20 deg by two oxyacetylene torches mounted on a portable, motor-driven carriage. Cutting speed was 8 ipm.

Studs were then arc welded on the backs of the wing plates for positioning in the jig prior to welding. The plates were fitted so as to leave a ⅜ in. root opening.

To bring the wing plates 90 deg to the flange after weld cooling and contraction, the wing plates were preset as much as 2½ in. wider at the top than at the bottom. Back-up bars were ¼ in. by ¾ in.

Automatic submerged-arc welding then joined the wing plate to the flange using 7/32-in.-diameter wire and Lincoln 780 flux. Power was provided by two motor generators in parallel with current settings of 400 to 1,000 amp at 32 to 40 volts.

Average welding speed for joining the wing plates to the flanges was about 12 ipm; although on the first pass, it was necessary to run 20 ipm to keep from burning through the back-up bar and to obtain full penetration into the corners. The number of passes depended on the section being welded, *e.g.,* heavy 369 lb sections took approximately eight passes.

After welding was completed, the studs were cut off the wing plates and the areas where the studs had been welded were ground smooth.

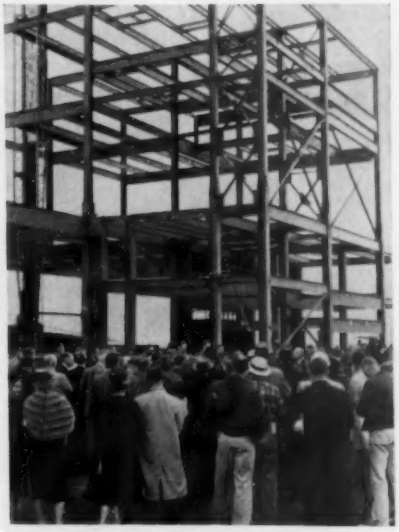
Semiautomatic submerged-arc welding was used to weld the stiffeners to the beams, which were placed in a vertical position to facilitate downhand welding. Wire diameter for this operation was 3/32 in. Power was provided by a single motor generator with current settings of 500 to 600 amp at 33 to 38 volts. The same type of flux was used here.

The girders spanning the width of the tower are 36-in. wide-flange sections weighing up to 300 lb per ft. Intermediate beams are 12, 16 and 18-in. wide-flange sections spaced on 6 ft centers.

Manual metal-arc welding was used to join the girders to the built-up beam columns. Using E6018 electrodes 5/32, 3/16 and ¼ in. in diameter, the six girders on each floor were fully butt-welded, flange and web, to the tower columns. Power source was a 500 amp a-c transformer.

Approximately 166,000 lb of filler metal were required in the shop fabrication of the main tower steel, and another 24,000 lb in its erection.

When completed the building will measure 120 ft. by 208 ft. The main tower is expected to be ready for occupancy by this fall and the entire building should be completed by late 1962.



BANK building (left) nears structural completion as guy derrick begins erection of two-story penthouse. Topping out ceremonies (above) were conducted soon after.

WELDOR "tacks" longitudinal wires of length of welded wire fabric to 3-in. by ¼-in. copper bar. Fabric will reinforce concrete floor of warehouse at Northern States Power Co.'s service center near Minot, N. D.

Wire fabric finds new markets

WORKER trims length of welded wire fabric to be used in warehouse floor slab. Fabric, to which power leads will be connected, will be embedded in 4-in.-thick course of concrete.

A PAIR OF RECENT AND UNUSUAL applications may expand the uses of welded wire reinforcement.

In one application, a revolutionary system was installed in which welded wire fabric doubled as a radiant heating element in a concrete floor.

In the other application, underwater concrete pipe sections, reinforced with welded wire, were designed to resist internal hydrostatic pressures of 45 psi.

The heating system was built into Northern States Power Co.'s new 6,500-sq-ft service center and warehouse near Minot, N. D.

Advantages of the double use of the welded wire include:

1—lower material cost.

2—economy over conventional radiant heating systems.

3—elimination of a furnace room (although space was necessary for transformers).

4—energizing of floor grid at night to store heat eliminates an increase in daytime demand.

To form the wire fabric, oxya-

cetylene welding was used with copper alloy rod (RCuZn-C).

In the Minot installation, there were three different types of welded wire fabric. All had 6-in. spacing between wires. Gages ranged from nearly ¼-in. diameter to 1/16-in. diameter.

To apply electric potential to the wire and to establish a path for the current flow, copper bars ¼-in. thick by 3-in. wide were welded across the width of the wire sections.

Longitudinal wires, running the length of the wire fabric, were tack welded to the copper bar. Clamps kept the wire and bar in close contact and oxyacetylene torch temperature was 2,200 F to 2,400 F — hot enough to weld but not hot enough to burn the wire.

Six dry-type transformers are used to power the radiant networks of welded wire fabric in the concrete slabs. Although 208 volts are applied to the transformers, potential applied to the wire is only 20 volts.

Current flow in the fabric is in the 500-600-amp range with 45 to 55 amp in each of the 11 longitudinal wires in each strip of fabric.

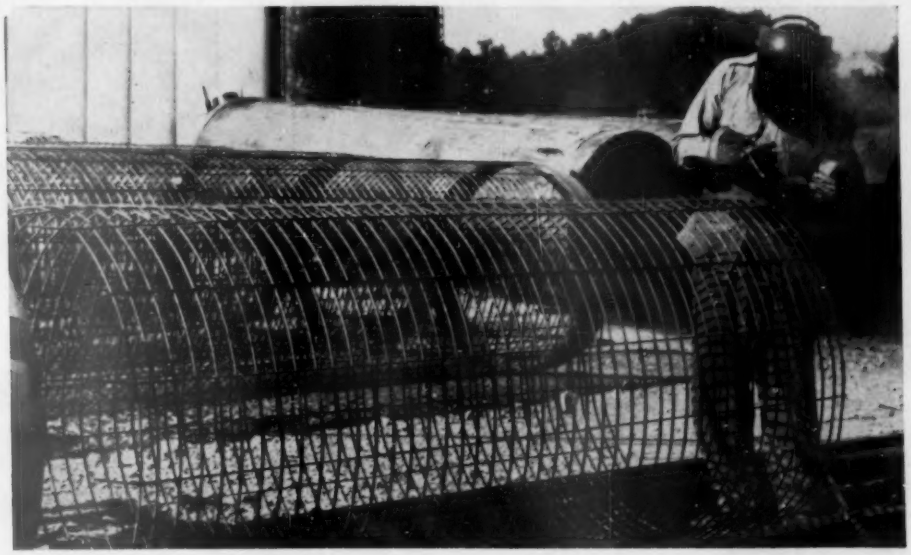
WELDOR joins cast steel anchor to outer wire fabric reinforcing cage for 16-ft pipe sections of Niagara River pipe line.

For the other project, a 2,800-ft pipeline was installed across the bottom of Niagara River's east branch. The pipe is part of the $10 million Niagara County Water District which will supply drinking water to towns in western New York State.

The 42-in.-ID, 51-in.-OD concrete pipe, reinforced with wire, is designed to guard against leakage and preserve water purity.

To join the wire fabric for the 16-ft pipe sections, overlapping circumferential wires were manual metal-arc welded to reinforcement cages. Cages were then butted to form a continuous cage for each pipe section. Steel bell-and-spigot joint rings were metal-arc welded to inner cage ends to form tight joints with other sections.

In addition, an anchor, embedded flush with the outer diameter of the pipe, secured the connecting lugs which hold the pipe sections together in the trench on the river bottom. The cast steel anchor was welded to the wire reinforcing cage for greater security.

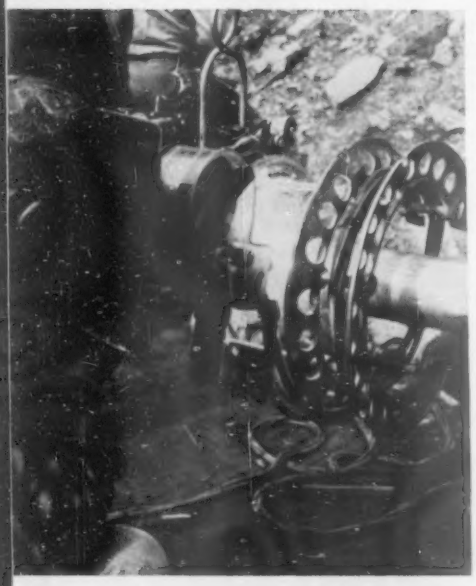


OVERLAPPING circumferential wires are tack welded to complete reinforcement cage for Niagara river low pressure concrete pipe.

Aluminum pipe line crosses two Kentucky mountains to join wells located 4,500 ft apart.

ONE of several improvisations to pull the pipeline from the welding station, across a mountain top, and lower it down the mountain, is demonstrated in photo at left.

Automatic welder joins aluminum gas line



MIG WELDING AND DRAG PIPELAYING have completed the first permanent aluminum pipeline in the Appalachian gas fields.

The line is part of a gas-gathering network tieing wells belonging to United Fuel Gas Co., Charleston, W. Va., to a cross-country transmission system. All pipe for the installation was supplied by Aluminum Co. of America, Pittsburgh.

The 4-in. aluminum pipeline connects two wells which are located 4,500 ft apart. To bridge the two Kentucky mountains between the wells, 5,700 ft of Schedule 40, 6061-T6 aluminum pipe were required.

The right-of-way for the line slices across terrain varying from slight slopes, 10 to 20 deg, to steep drops of 50 deg. Ordinarily pipe would be strung along the ditch and welding equipment moved up and down the steep mountains.

WELDOR (above, left) joins pipe sections with automatic Mig pipe welding machine located on mountain top. Steel cable attached to the bulldozer at left holds in check a second bulldozer farther down the mountainside.

However, once the trench was dug, aluminum pipe and a 65-lb automatic Mig pipe welder were stationed on top of the first mountain. As each 40-ft pipe section was joined, the entire line was pulled along the right of way until the next joint was positioned.

Welding was done by a Mig welder traveling the pipe circumference and making multiple passes. Butt welds were completed in about 50 seconds.

The welding machine weighed only 65 lb which eased handling procedures in the rough terrain. A 0.035-in.-diameter, 5154 alloy wire was used to weld the pipe ends. Wall thickness of pipe was 0.237 in.

Aluminum's modulus of elasticity made it possible for the pipeline to bend and curve following the contour of the ditch as it was pulled along the mountain to the well.

A similar line was run down the other side of the mountain and the two 1,700-ft lengths were joined at the welding station.

Thus, the first mountain was crossed.

Welding equipment was then moved to the other well on the far side of the second mountain. As pipe was joined, the entire line was pulled up the side, across the top, and lowered to the valley floor to meet the free end of the line running from the first mountain.

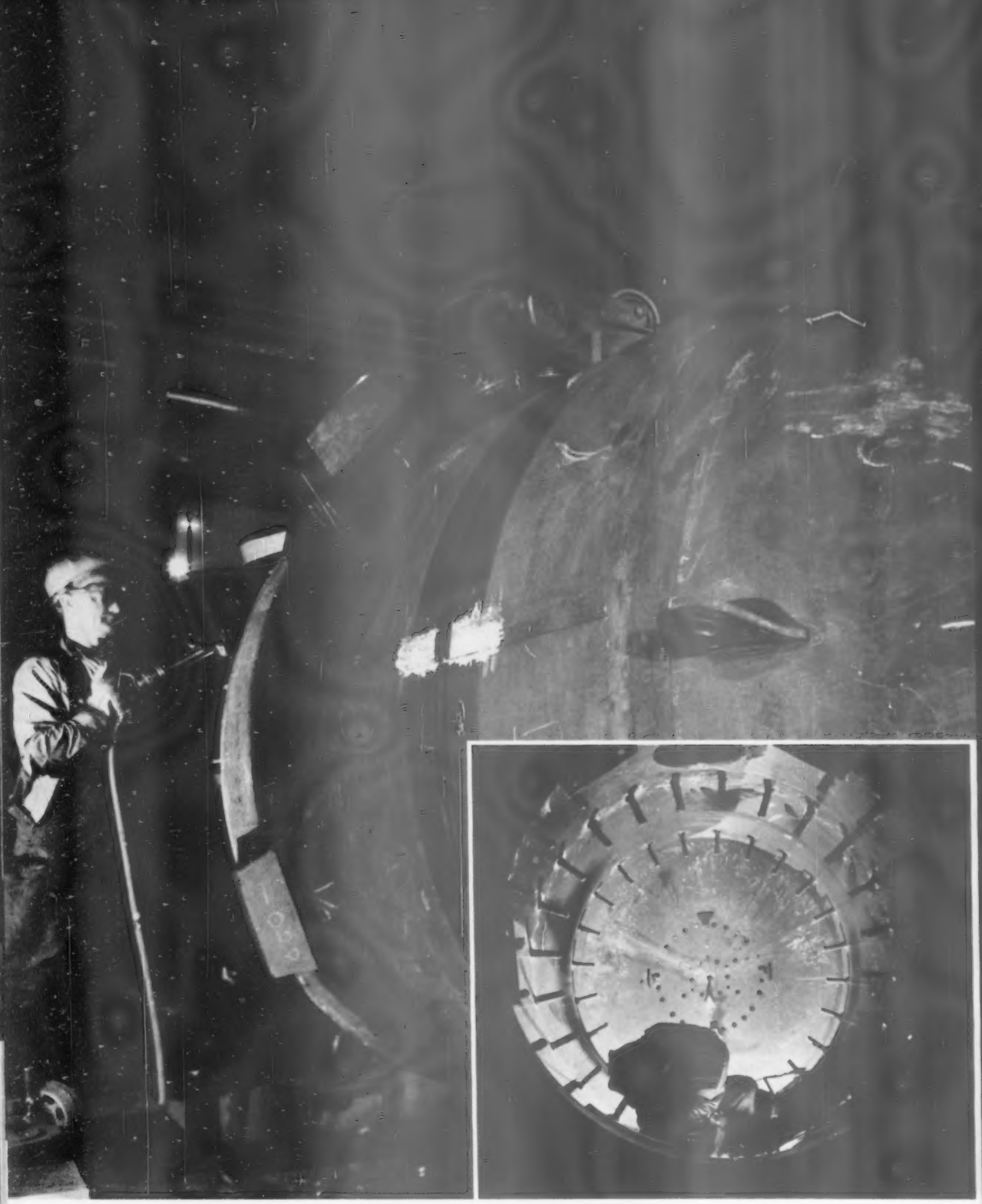
The uncoated, unwrapped magnesium-anode protected pipeline was buried after the last weld connected the two sections.

Got a Welding Problem? Read how . . .

McKay Stainless Steel Electrodes and Wires helped Pacific Coast Engineering Company build a "no margin for error," 34-foot pressure vessel for AEC Test Reactor.

McKiernan-Terry Corporation, with the help of McKay 7018 Low Hydrogen Electrodes, was able to fabricate a lightweight, mobile diesel pile hammer with strength equal to a cast iron or forged pile hammer.

Peabody Coal Company, after switching to McKay Tube-Alloy 240-0 Wire, is getting 400% longer life from hard surfacing material for bucket teeth.



ABOUT PACIFIC COAST ENGINEERING COMPANY

Pacific Coast Engineering Company was founded 38 years ago as a manufacturer of dredge parts. Today, in addition to dredge parts and nuclear equipment the company also custom designs and fabricates heavy equipment including TransTainers, Port Cranes, Shipboard Cranes, and Hydro-electric Equipment for dams, namely Gates, Cranes, Valves and Penstocks.

APPLICATION DATA

Pacific Coast Engineering Company used 3/32 inch McKay Stainless Steel Wire, using submerged arc technique, for the stainless steel cladding, and 1/4 inch coated stainless steel electrodes for the metal overlay on the nozzles.

McKAY STAINLESS STEEL Electrodes & Wires

. . . *provide flawless overlays on pressure vessel for AEC reactor*

McKay Stainless Steel Electrodes and Wires help Pacific Coast Engineering Company build a "no margin for error," 34-foot pressure vessel for an Atomic Energy Commission Heavy Water Components Test Reactor. This critical pressure vessel currently is being fabricated by Pacific Coast Engineering Company of Alameda, California for installation at a major AEC installation. Shell of the vessel is made from five-inch steel plate clad with Stainless Steel. Butt welds were overlayed to produce one-quarter-inch cladding approximately Type 304 in composition. On completion the unit is designed to operate at an internal pressure of 1500 pounds per square inch at a maximum power output of 61000 kilowatts.

"By the time welding is completed, we will have used about 10,750 pounds of McKay Welding Electrodes and Wires," states Robert Boyer, Supervisor of Engineering for Paceco. This tonnage includes both bare wire and coated electrodes.

Rigorous inspection is a "must" throughout all the various welding procedures. All stainless steel overlay welds are examined using dye penetrant and ultrasonic testing procedures.

"We have complete confidence in the quality of welds made using McKay Welding Wires and Electrodes," Mr. Boyer declared. "We have used McKay products for years and they have never let us down on the job. Naturally, on any job as critical as this component, it is essential that we use dependable welding materials — McKay Welding Wires and Electrodes definitely belong in that category."

Overlay procedure called for layer of Type 309 weld metal adjacent to steel base material. This, in turn, was overlayed with two layers of Type 308 ELC material. Submerged arc welding with McKay Welding Wires was used wherever practical. Butt welds, flanges, nozzle forgings, were welded manually using McKay Stainless Steel Electrodes.

Like Paceco, if you have an application for welding stainless steels, you should investigate McKay Stainless Steel Electrodes and Wires. McKay quality products can bring the same benefits to you.

"There is no margin for error, or tolerance of even a slight flaw in this pressure vessel we are building for the Atomic Energy Commission," said Mr. Robert Boyer of Pacific Coast Engineering Company. "That's why we chose McKay Stainless Steel Electrodes and Wires for overlays."

See back page for helpful McKay literature

THE McKAY COMPANY

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- ARC-WELDING ELECTRODES
- WELDING WIRES
- INDUSTRIAL CHAIN
- TIRE CHAINS
- AUTOMATIC WELDING EQUIPMENT

ABOUT PEABODY COAL COMPANY

Peabody Coal Company has 29 mining operations and two billion tons of proven coal reserves strategically located in the rapidly expanding midwestern section of the nation. Peabody Coal's Northern Illinois Mine, which employs about 155 persons in round-the-clock operations, was purchased from Northern Illinois Coal Corporation in 1950. Customers receive rail or truck deliveries directly from the mine which currently has a 17-year coal reserve. In 1960, Peabody Coal Company mined more than 28 million tons of coal.

APPLICATION DATA

Eight lines are stripped vertically for 13 inches on an A-shaped bucket tooth. The tip or cutting edge is fortified by a ¾ inch wide strip placed horizontally across the base. The surface of the cutting edge receives an automatic weldment. Finally, the leading edge of the tooth receives a double pass of McKay 240-0 Wire on each side and an additional pass along the edge itself.

McKAY TUBE-ALLOY 240-0 WIRE

. . . gives 400% longer life than previously used hard surfacing material for Peabody Coal's Bucket Teeth.

"Weld metal deposited by McKay Tube-Alloy 240-0 Semi-Automatic Welding Wire gives 400% longer life than the material we previously used to hard surface our T-1 steel bucket teeth," said Mr. Sanders Payne, superintendent for Peabody Coal Company's Northern Illinois Mine in Braidwood, Illinois.

Deposits from McKay 240-0 Wire protect the six digging teeth of the company's three crawler drag lines used in a 700,000 ton strip mining operation. Each drag line removes 21,000 cubic yards daily from the 85-foot overburden to uncover a 36-inch vein of soft bituminous coal.

Before switching to McKay Tube-Alloy 240-0 Wire, Peabody Coal got only seven days service from each surface-hardened tooth. Now, teeth overlayed with weld metal deposited by McKay Tube-Alloy 240-0 weld metal lasts 30 days.

They also reported that not only does the McKay Wire give longer service life, it's easier to apply. *Now it takes only three minutes* to apply material which formerly required 12 minutes.

"When we investigated McKay, we ran tests comparing McKay 240-0 Wire with the other wire we had been using," said Mr. Payne. "Passes were made with the competitive material and McKay's 240-0, alternating the two across the face of a bucket tooth."

"There simply was no comparison because after each period of service, we had to touch up competitive overlay without touching McKay deposit. It didn't take long for us to realize that McKay 240-0 Wire was much more suited to our type of operation than wire formerly used."

Coming out on top in side-by-side comparisons with other materials is a tradition for McKay Welding Wires . . . and Electrodes. No matter what your needs — Mild, Stainless, Special Purpose, Hard Surfacing Electrodes and Wires — look to McKay to satisfy your welding requirements.

"McKay 240-0 Wire helps welders keep their productivity high and gives our bucket teeth much more wear," said Mr. John Foreman, master mechanic at Peabody Coal Company's Northern Illinois Mine. "Considering the fact that welders command top hourly wages, high productivity from each of them is important to help maintain our 30 tons of coal per man production rate."

See back page for helpful McKay literature

THE McKAY COMPANY

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• INDUSTRIAL CHAIN • TIRE CHAINS
• AUTOMATIC WELDING EQUIPMENT

ABOUT McKIERNAN-TERRY CORPORATION

The McKiernan-Terry Corporation is an organization of manufacturing engineers specializing in the design, engineering and manufacture of precision equipment for industrial and defense markets. The Construction Equipment Division is recognized for the efficiency and durability of its products which, the company reports, has led its field for more than 50 years. McKiernan-Tery pile hammers are marketed internationally.

APPLICATION DATA

McKay 7018 Electrodes — in 1/8", 5/32", 3/16" and 7/32 sizes — make welds usually in one pass at an averag 5/16" width for the flanges, cowling, fuel and lubricatio tanks, oil housings, exhaust ports, spring housings an cooling fins on McKiernan-Terry diesel pile hammer

McKAY

7018 LOW HYDROGEN ELECTRODES

. . . *'give best possible welds' for McKiernan-Terry Pile Hammers*

The most critical impact and vibration areas of McKiernan-Terry Corporation's diesel pile hammers — the spring housings and cooling fins — are getting "the best possible welds" from McKay 7018 Low Hydrogen Electrodes, according to Mr. W. C. Osha, weld shop superintendent for McKiernan-Terry in Dover, N. J.

McKay 7018 Electrodes help McKiernan-Terry produce lightweight, mobile diesel pile hammers with weldments strong enough to withstand 70,000 psi and impact as the hammers strike with a force that is as high as 32,000 foot pounds.

"Weight is a very important consideration in making our diesel pile hammers," Mr. Osha said. "Because these McKay Electrodes have excellent ductility and impact characteristics, we can fabricate a lightweight product with strength equal to a cast iron or forged pile hammer.

"Thanks to the lighter weight and structural soundness of our diesel pile hammers — to which McKay Electrodes contribute considerably — we can compete successfully with heavier steam and air-operated pile hammers that are much more expensive to operate and maintain."

McKiernan-Terry Corporation prefers McKay 7018 Electrodes for another important reason: the local McKay distributor who regularly provides solutions to troublesome production problems. "This distributor has an extremely competent welding engineer who has helped us solve many problems in developing pile hammers," Mr. Osha explained.

If you have a welding problem, it will pay you to investigate McKay Electrodes, Welding Wires . . . and your nearby McKay supplier. Like McKiernan-Terry, perhaps you too can benefit from McKay welding products and know-how.

"We have conducted many on-the-job spot checks on McKay 7018 Electrodes and in each test the McKay Electrodes have never failed us," reported Mr. W. C. Osha, weld shop superintendent for McKiernan-Terry Corporation. "McKay welds are applied with no porosity — no spongy welds that would eventually shake loose and disintegrate from vibration."

nd 7/32"
average
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"HELPS"

FROM THE McKAY COMPANY

LITERATURE AVAILABLE

Hard Surfacing Catalog—Contains full information on all McKay Hardalloy Hard Surfacing Electrodes and Tube-Alloy Welding Wires, plus check list of 500 applications.
For your copy circle No. 200 on Literature Request Card.

McKay Selector Chart—A complete guide to the selection and use of McKay welding products including all classes of mild steel, stainless steel, special purpose, hard surfacing electrodes, automatic and semi-automatic wires.
For your copy circle No. 201 on Literature Request Card.

The Welding of Mild Steels—Catalogs specifications, operating characteristics, properties, uses and other data about the McKay Mild Steel, Low Alloy, Low Hydrogen Electrodes.
For your copy circle No. 202 on Literature Request Card.

Welding of Stainless Steels—A 24-page book which provides detailed data on chemical analysis, mechanical properties, corrosion resistance and types of electrodes available for welding stainless steels.
For your copy circle No. 203 on Literature Request Card.

Hard Surfacing Manual (Earth Moving Equipment) —This manual provides detailed information and procedures for deposition of alloys for proper build-up and/or hard surfacing of over 30 illustrated parts used for heavy earth moving equipment.
For your copy circle No. 204 on Literature Request Card.

Guide on Welding Stainless Steel—6-page folder contains handy chart on the chemical and physical specifications of McKay Stainless Steel Electrodes.
For your copy circle No. 205 on Literature Request Card.

McKay Comparison Chart — A handy and useful guide in matching brand name electrodes with AWS class or A.I.S.I. grade. Listed are all electrode classifications of The McKay Company with all major manufacturers' electrodes which fall into each individual class.
For your copy circle No. 206 on Literature Request Card.

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- ARC-WELDING ELECTRODES
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- AUTOMATIC WELDING EQUIPMENT

Roll welding corrugated-core sections, which can be extensively formed after assembly, results in . . .

Low-cost sandwich panels

A NEW ROLL-WELDING PROCESS has been developed to produce corrugated-core sandwich panels at substantially reduced costs.

The method, developed from research sponsored by the Douglas Aircraft Co. at Battelle Memorial Institute, Columbus, Ohio, requires no jigging. In addition, it provides completely sound core-to-cover bonds and allows the panels to be extensively formed after assembly.

The process uses hot rolling to pressure weld corrugated metal core peaks to cover sheets, and sandwich panel size is limited only by rolling-mill capacity. Panels ¼-in. thick and as large as 30 in. by 72 in. have already been produced.

Roll-welded sandwich panels have been made of 2014 aluminum alloy, B-120 VCA titanium, unalloyed A-55 titanium, steel, molybdenum, and Inconel.

To form the corrugated core, an accordion-pleated metal sheet is woven over and under vee-shaped inserts of a chemically-soluble deformation-resistant metal such as iron or copper. A rectangular metal frame is then placed around the core and face sheets of the sandwich are added.

The entire assembly is clamped in place by two additional metal cover sheets, which are welded to the rectangular frame. The whole package is then hot rolled in a direction parallel to the corrugations.

In addition to welding the core to both covers, rolling also reduces panel thickness up to 60% to provide desired corrugation shapes.

After rolling, the retaining frame is sawed or sheared off and metal covers which were welded to the frame are peeled away. With the support wedges still in place, the sandwich panel can then be formed into a wide variety of shapes, including hemisheres, without buckling the core.

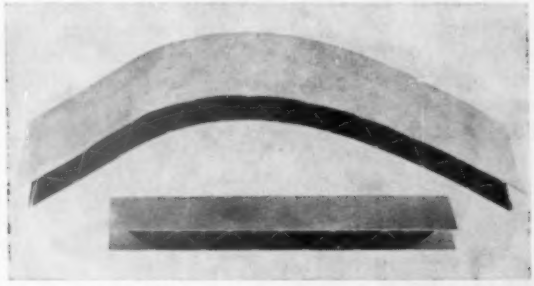
Standard tooling can be used, and the panel can be worked as though it were a solid metal plate of equal thickness.

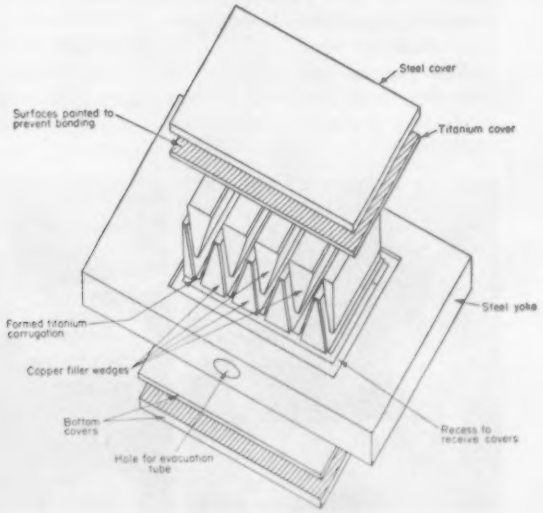
Vee-shaped inserts are then leached out of the formed structure with a chemical reagent such as nitric acid. Although this leaching process requires several days for very large panels, it is a relatively inexpensive and simple operation. If necessary, leaching can be accelerated by mechanical means.

Roll-welding can also be used to produce sandwiches with vertically ribbed cores, since core design is determined by filler wedge design.

The only limitation is that the core has to be unidirectional.
tically ribbed cores, since core design is determined by filler wedge

These finished roll-welded corrugated sandwich panels approach the all-around rigidity of honeycomb sandwiches and yet are simpler and much less costly to manufacture.

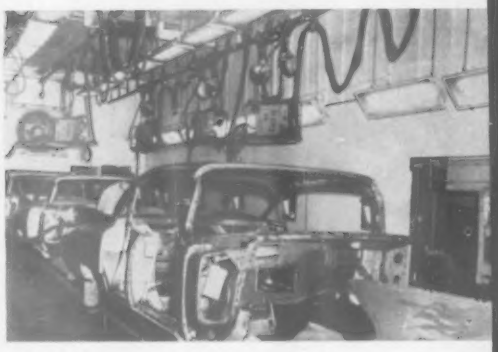




ELEMENTS of the sandwich pack are held in place during hot rolling by steel cover sheets welded to a rectangular steel frame (right). After rolling, the frame is sheared off and protective covers are peeled away. Finshed panel is produced by leaching out inserts with acid (above). Corrugated-core sandwich panels approach the rigidity of honeycomb sandwiches and are simpler and much less expensive to manufacture.

In some plants, 1,000 to 1,500 spot welds per hour are produced

Speed auto-body production by 40%



MIG spot welding control units are rail mounted above the auto body assembly line.

PRODUCTION TIME SAVINGS of as much as 40% are being made in a Detroit automotive body plant with Mig spot welding.

In some plants, 1,000 to 1,500 spot welds per hour are made with the process, according to J. A. Howery and G. F. Mack of National Cylinder Gas Div. of Chemetron Corp., Chicago.

Speaking at the 42nd Annual AWS Meeting in New York on April 20, they reported that with the process an operator can weld 3 to 20 times faster than with manual metal-arc welding.

Automatic electronic equipment overcomes the control inadequacies which have been the major problem in Mig spot welding on a mass production basis. Characteristics of the nugget-shaped weld are controlled by the arc duration time and electrode feed rate.

Material costs are comparable to, or slightly less than, manual metal-arc tack welding or resistance spot welding, and physical properties of welds are said to be equal or higher. One 5/8-in.-diameter spot weld nugget is reportedly equivalent to one lineal inch of arc weld.

The process can be used to join low and medium carbon steels and low-alloy high-tensile steels in 0.035-in. to ¼-in. thicknesses. It can also be used to fabricate stainless and aluminum alloys.

The continuous electrode is 3/64-in. to 3/32-in.-diameter solid or flux-cored wire. An argon-oxygen mixture or carbon dioxide alone are used as shielding gases depending on the metals to be joined and the electrode employed.

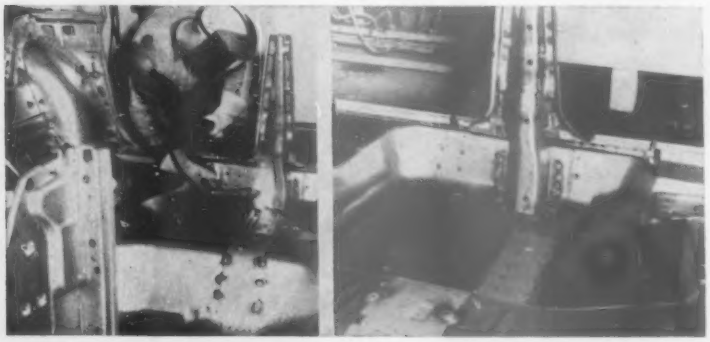
Welding time per spot is adjustable from 0 to 360 cycles of standard 60 cps line frequency, or from 0 to 6.0 seconds. Burn-back control allows the electrode to burn back to a predetermined length by permitting brief, adjustable time delay between the stopping of electrode feed and opening of the welding contactor. This prevents the electrode from freezing in the weld pool or burning back into the welding gun.

The specially-designed water-cooled gun is operated with a spring-loaded trigger.

Either d-c rectifier or motor-generator types of constant potential welding power sources having an upper limit of 40 to 50 volts may be used. Amperage ratings should be from 400 to 500, at 100% duty cycle. D-c rectifier power sources, designed for automatic and semi-automatic operations, and preferably those having an internal welding contactor, are recommended.

Power source voltage setting determines arc length and physical shape of the weld nugget. Small-diameter high-crown nuggets and deep penetration are characteristic of low welding voltages. Higher voltages give longer arc length, larger diameter, flatter nuggets and less penetration.

Flow rate of 95% argon-5% oxygen shielding gas mixture is approximately 20 cfh. Straight carbon dioxide shield, with flux-cored electrode, gives greater tensile strength welds but, because of increased heat transferred by the arc, control adjustment, joint tolerance and selection of metal combinations are more critical. Carbon dioxide flow rates are about 44 cfh.

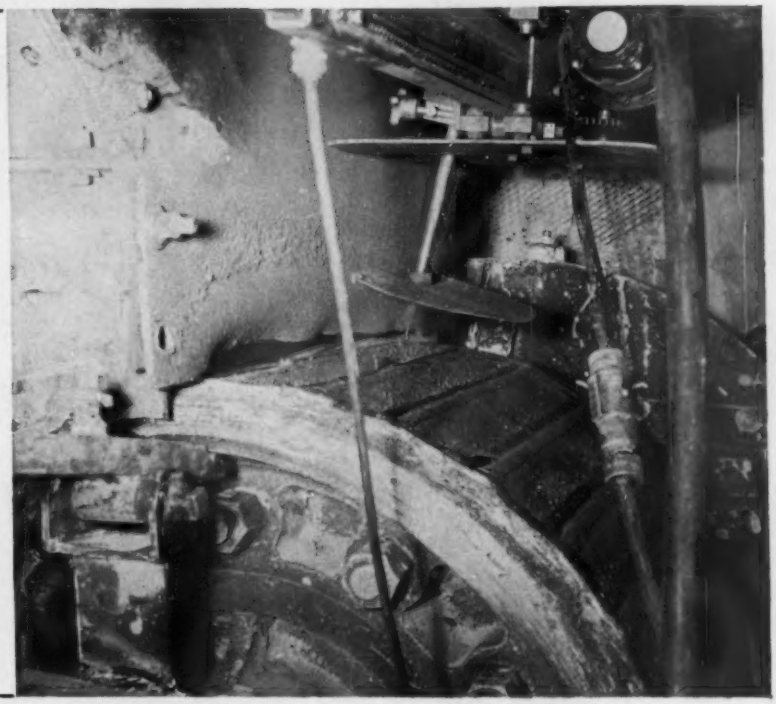


WELDOR (at left) joins center post to automobile body with semi-automatic Mig gun. Completed assembly of center post to body (right) shows nugget-shaped welds.

Announcing the

STOODY CRUSHERMATIC

a system for automatically rebuilding and hard-facing crusher rolls ***in position!***



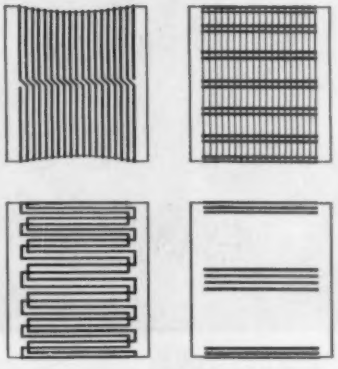
The Stoody CRUSHERMATIC is a new tool for the aggregate producing industry! It cuts rebuilding and hard-facing time on crusher rolls as much as 300 to 400% over manual welding and is 200% faster than hand-held semi-automatic welding!

Now you can gain 50% *more crushing time*—get an *additional 30% more production* from the same crusher because rolls are *kept* out to size... are far more efficient!

Crushermatic is completely portable... ready to use in 20 minutes. It consists of a reciprocating, motorized carriage and wire nozzle supported on a rail over the crusher roll. Continuous wire, fed through the nozzle, can be deposited in a variety of weld patterns—all made possible by a versatile electronic control and an independent slow-speed roll drive. Crushermatic deposits up to 20 lbs. per hour, utilizing a standard semi-automatic wire feeding unit and power supply capable of 100% duty cycle. Deposits are sounder and more uniform than with manual or hand-held semi-automatic application.

Crushermatic does not replace your weldor—it simply removes him from the cramped smoke-filled area of welding. He sets up the unit, supervises welding *from outside the crusher*. It's safer, faster and eliminates long hours of back-breaking labor.

Detailed Crushermatic data is available from your Stoody Distributor—check the Yellow Pages of your phone book—or write direct!



A wide range of weld patterns can be set up with the electronic controls for rebuilding any specific wear problem.

STOODY COMPANY

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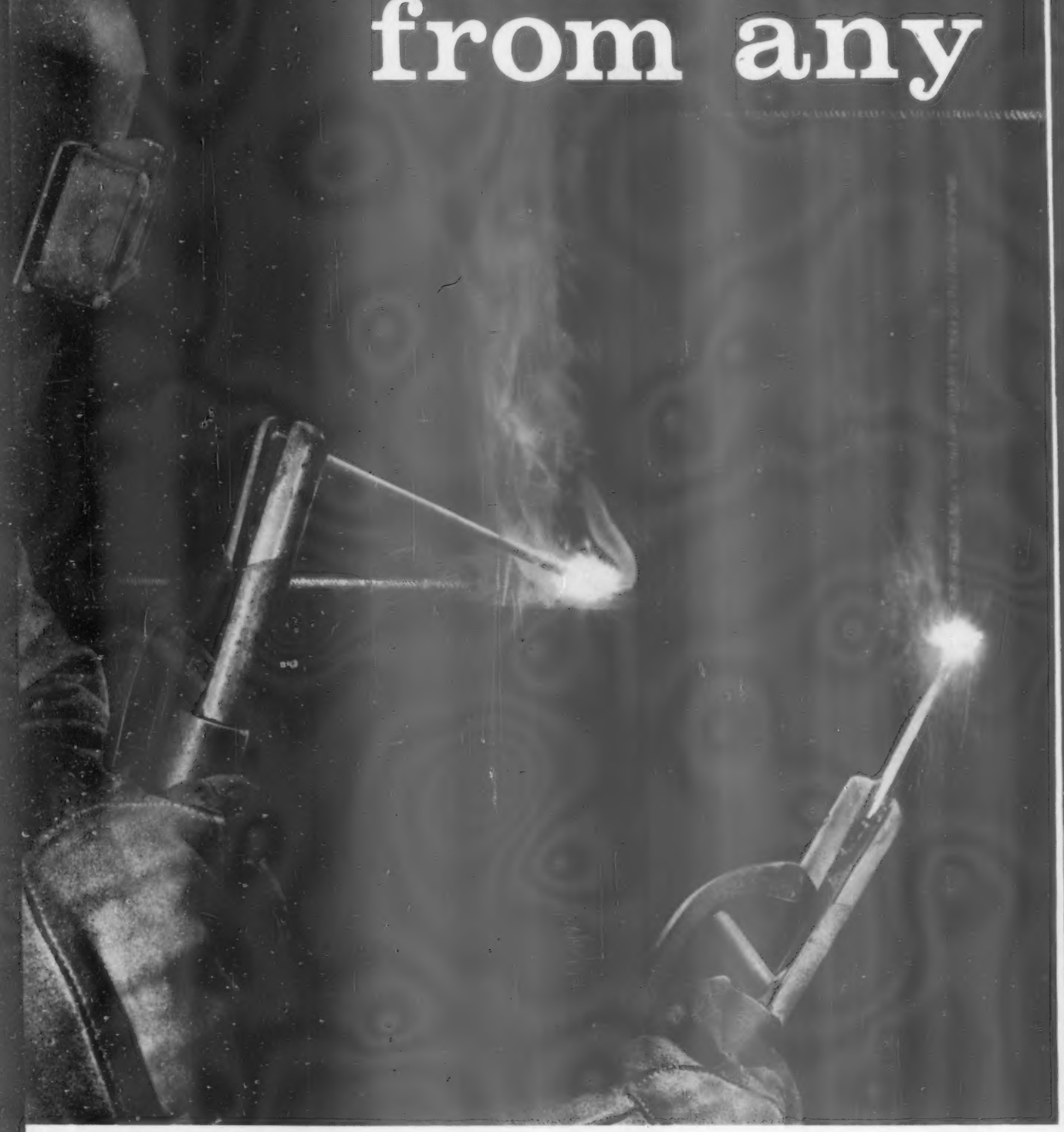
from any



HORIZONTAL — Try the new SW610 on single and multipass fillets and you'll find it superior to any electrode in its class. A less convex bead, due to better wetting action with sufficient throat reinforcement to prevent cracking . . . a quieter, smoother arc, producing far less spatter . . . a stronger coating crater or flux crucible for better arc direction and deeper penetration. From the standpoint of value — greater operator appeal and higher deposition efficiencies, resulting in less cost per pound of deposited metal.

VERTICAL DOWN — Here's where the SW610 is really in a class by itself. It's the only E6010 electrode capable of depositing a vertical down stringer pass free of pits. And this really "shows up" where x-ray checking is required. This advantage, coupled with its strong coating crater and deep penetration, makes the SW610 a natural for pipe welding. From the standpoint of value — rejects and rework time are reduced to an absolute minimum, especially when radiographic requirements must be met.

you can put metal where you want it with the new A.O.SMITH SW610

The new A. O. Smith SW610 outperforms any electrode in the E6010 class. In fact, it's so good in all positions that you might say it's in a class by itself.

You get all this with the SW610: Strong coating crater for good arc direction . . . greatest resistance to breakdown . . . no pitting in the vertical down position . . . smoother metal transfer for maximum operator appeal . . . deep penetration for rough jobs . . . better wetting action, producing less undercut . . . less spatter, resulting in reduced cleaning time.

Welds too good to be true. All you have to do to test the SW610 is to send for free sample electrodes. Or get in touch with the A. O. Smith representative near you.

OVERHEAD — Better arc direction is the secret of SW610's amazing out-of-position efficiency. No loss of arc direction due to electrode breakdown and weak crater. Instead, a strong coating crater produces better arc direction, enabling operator to put metal where he wants it . . . smoother metal transfer results in less spatter . . . fast-setting slag and good wetting action produce a desirable flat bead. From the standpoint of value — easy out-of-position welding with costly stub loss reduced to a minimum.

Through research . . . a better way

A.O.Smith
CORPORATION
WELDING PRODUCTS DIVISION
A. O. SMITH INTERNATIONAL S. A.
Milwaukee 1, Wisconsin, U.S.A.

For more facts Circle No. 191 on Welding Info-Aid Card

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TEC Watercooled Pencil Torch

TEC Aircooled Torch

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Hundreds of satisfied users have depended upon TEC to answer their welding problems whether small or complex. TEC is proud of the industry's acceptance and demand for its products . . . delighted with the countless reports of savings amounting to as high as 40% in gas consumption, in inventory, in time and labor. If you are not already enjoying the advantages of TEC TIG welding, then why not "LEAN" on TEC. Contact your nearest TEC distributor or write TEC directly without delay.

BE SURE
To send for the
Free brochure about
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NEWEST & TINIEST
TORCH!
You saw it at the
A.W.S. Show

**Vycor is a registered trade name of Corning Glass Works, Inc.*

TEC TORCH COMPANY, INC., EAST RUTHERFORD, N. J.
MANUFACTURERS OF VISUWELD EQUIPMENT

SEE OUR SPECIFICATIONS IN VSMF THE MICROFILM CATALOG FILE

NEMA standard for covered electrode identification

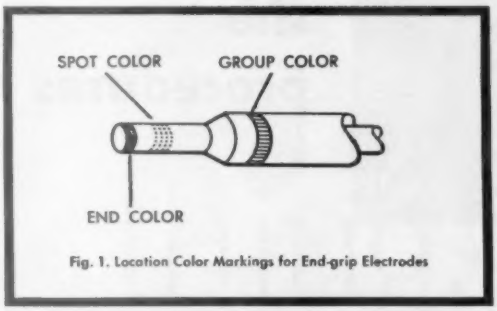

Fig. 1. Location Color Markings for End-grip Electrodes

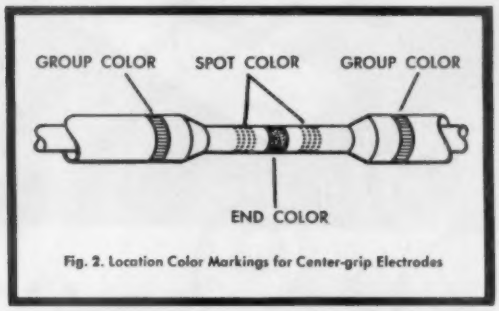

Fig. 2. Location Color Markings for Center-grip Electrodes

CLASS	END COLOR	SPOT COLOR
Mild Steel and Low-Alloy Steel XX10, XX11 and all 60XX GROUP COLOR—NONE		
E6010	None	None
E6011	None	Blue
E6012	None	White
E6013	None	Brown
E6015	None	Red
E6016	None	Orange
E6020	None	Green
E6024	None	Yellow
E6027	None	Silver
E7010	Blue	None
E7010-A1	Blue	White
E7011	Blue	Blue
E7011-A1	Blue	Yellow
E8010	White	None
E8010-B1	White	Brown
E8010-B2	White	Green
E8011	White	Blue
E8011-B1	White	Black
E9010	Brown	None
E9010-B3	Brown	Green
E9011	Brown	Blue
E9011-B2	Brown	Black
E10010	Green	None
E10011	Green	Blue
Low-Hydrogen Low-Alloy Steel XX15 and XX16 GROUP COLOR—GREEN		
E7015	Blue	Red
E7015-A1	Blue	White
E7016	Blue	Orange
E7016-A1	Blue	Yellow
E8015	White	Red
E8015-C2	White	White
E8015-B1	White	Brown
E8015-B2	White	Green
E8016	White	Orange
E8016-B1	White	Black
E8016-C1	White	Blue
E8016-C2	White	Violet
E8016-B2	White	Gray
E9015	Brown	Red
E9015-B3	Brown	Green
Mil 82-15	Brown	Bronze
E9016	Brown	Orange
E9016-B2	Brown	Black
E9016-B3	Brown	Blue
Mil 82-16	Brown	Violet
E10015	Green	Red
E10016	Green	Orange

CLASS	END COLOR	SPOT COLOR
E10016-B3	Green	Black
E12015	Yellow	Red
E12016	Yellow	Orange
Mil 230-15	Silver	Red
Mil 230-16	Silver	Orange
Low-Alloy Steel All XX13 and XX20 except E6013 and E6020 GROUP COLOR—SILVER		
E7013	Blue	Brown
E7013-A1	Blue	White
E7020	Blue	Green
E7020-A1	Blue	Yellow
E8013	White	Brown
E8013-B1	White	White
E8020	White	Green
E9013	Brown	Brown
E9013-B2	Brown	White
E9020	Brown	Green
E10013	Green	Brown
E10013-B3	Green	White
E10020	Green	Green
Chromium and Chromium-Nickel Steel GROUP COLOR—BLACK FOR DÇ, YELLOW FOR AC-DC		
E308	Yellow	None
E308ELC	Brown	None
E309	Black	None
E309Cb	Black	Blue
E309Mo	Black	White
E310	Red	None
E310Cb	Red	Blue
E310Mo	Red	White
E312	Green	Red
E316	Yellow	White
E316ELC	Brown	White
E317	Yellow	Brown
E318	Yellow	Green
E330	Green	None
E347	Yellow	Blue
E410	Gray	Brown
E430	Gray	Green
E502	Gray	Blue
Mil 308-MoL & MoT	None	None
Mil 307-MoL & MoT	None	Black
330HC	Green	Black
349	Yellow	Orange
442	Gray	Red
446	Gray	Yellow
505	Gray	White

CLASS	END COLOR	SPOT COLOR
Copper and Copper-Alloy GROUP COLOR—BLUE		
ECu	Green	None
ECu-Si	Red	None
ECu-SuA	Yellow	None
ECu-Ni	None	Blue
ECu-SuC	Yellow	Blue
ECu-A1-A2	Silver	Blue
ECu-A1-B	Silver	Brown
Cu-A1-C	Silver	Green
Cu-A1-D	Silver	Red
Cu-A1-E	Silver	Yellow
Nickel, Nickel-Alloy and High Temperature Electrodes GROUP COLOR—WHITE		
E3N10	Blue	White
E4N10	Blue	Brown
E3N14	Blue	Red
E3N1B	White	Green
E3N1C	White	Violet
E4N12	Green	Brown
E3N11	Yellow	White
E4N11	Yellow	Brown
E3N12	Violet	White
E3N19	Violet	Red
ENi	Orange	Blue
ENi-Cu	Orange	White
ENi-Fe	Orange	Brown
ENi-CuB	Orange	Green
Ni-Cr60-13	Green	Blue
Ni-Cr80-15	Green	White
Mi14N1W	White	Yellow
Mi13N1L	Bronze	White
Ni13N1N	Bronze	Orange
Surfacing Electrodes GROUP COLOR—RED		
EFeMn-A	Blue	None
EFeMn-B	Blue	Blue
EFeCr-A1	White	None
EFeCr-A2	White	Blue
EFe5-A	Brown	None
EFe5-B	Brown	Blue
EFe5-C	Brown	White
ECoCr-A	Green	Red
ECoCr-B	Green	Green
ECoCr-C	Green	Black
ENiCr-A	Red	None
ENiCr-B	Red	Blue
ENiCr-C	Red	White

Courtesy of National Electrical Manufacturers Association

Here are the procedures

HARDFACING IS A LOW-COST means of extending the service life of equipment subjected to some form of wear.

It consists simply in the placing of a thin layer of wear-resistant material, usually by means of manual metal-arc welding, on parts receiving inservice wear.

But to take full advantage of the economics of this process, three basic steps must be followed:

1 — Investigate the job itself.

2 — Select the proper hardfacing material.

3 — Deposit the material correctly.

Of the three, the first is of prime importance. A thorough investigation to determine what the part is, what the function of the hardfacing will be, and what type of wear exists will greatly simplify execution of the last two steps.

Hardfacing is basically not difficult. But it does require some additional knowledge of welding beyond that of routine maintenance or production welding.

All hardfacing deposits resist some type of wear. Some mainly resist abrasion, the most common type of wear. Others withstand severe pounding, which may cause the more highly abrasion resistant materials to fail.

Still another group resists corrosion from chemicals or high temperature oxidation. Whatever the wear problem, there is a deposit to resist that wear and increase the life of the part.

Hardfacing materials, however, are different from mild steel and react quite differently to the heating and cooling cycles encountered in welding. Hence, they must have exceptional properties and must be of alloy steels. (*See boxed material.*)

The first step in analyzing the hardfacing job is to consider the shape and dimensions required.

The size and shape of the part to be hardfaced has a great effect on the cooling rate of the weld deposit. If the mass is large, the part will cool quickly. But if the part is small, the cooling rate may be very slow.

Since the cooling rate effects the hardness of some deposits, it is possible on certain large parts to produce very brittle deposits, or on small parts to produce deposits softer than anticipated

Thus, it is often necessary to adjust the welding procedures to the size of the part to obtain the desired cooling rate.

Size and location of the area to be hardfaced will, in a few special cases, influence electrode selection.

For example, a very small area requires the use of low current and, hence, a small electrode. In addition, hardfacing electrodes operate best in the flat or downhand position. So if there are welds to be made in several planes, it is best to plan on positioning the work to accommodate downhand welding.

Thickness of weld deposits will influence both electrode selection and welding procedures. If a thick deposit is required, it is generally best to build up all but the last two layers with a tough material.

The last two layers can then be applied to produce a deposit of the desired wear resistance.

Most hardfacing deposits are satisfactory when used with the finish normally obtained from welding. There are, however, some applications which necessitate a smoother finish.

In this case, then, it becomes a matter of econonomics to evaluate the cost of finishing compared to the wear resistance to be provided.

Mild steel, non-ferrous and stainless steel deposits can be machined in the as-welded condition. Lower alloy martensitic deposits can also be machined if the proper welding procedures are used in depositing the material.

Any of the martensitic or semi-austenitic deposits can be machined by annealing the deposit to a soft state. These deposits then can be rehardened through heat treatment.

The chrome-carbide deposits must be ground to

All data and photographs courtesy The Lincoln Electric Co., Cleveland.

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And a look at hardfacing metallurgy

ANY STEEL is basically an iron containing carbon and other alloying elements.

Mild steels used in normal fabrication contain, besides carbon, small amounts of manganese, sulphur, phosphorous and silicon. Generally, these elements total less than 1½% of the materials in the steel, the remainder being iron.

In alloy steels, however, up to 50% of the materials may be alloys, such as nickel, chromium, molybdenum, vanadium and tungsten. These change the steel's properties to better meet the special requirements of specific applications.

These alloys generally improve:

(a) Mechanical properties of steel through control of the factors influencing hardenability.

(b) Mechanical properties of steel at elevated or exceptionally low temperatures.

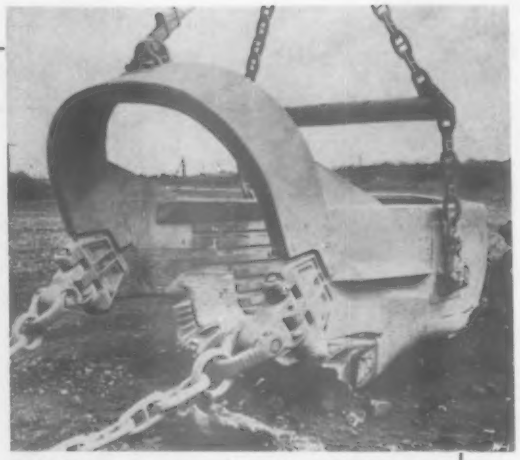
(c) Resistance to chemical attack and to elevated temperature oxidation.

Carbon influences steel properties in a somewhat different manner than alloys. It is the most effective element for increasing tensile strength, hardness and abrasion resistance. However, at the same time, it decreases ductility and ability to absorb impact, and increases the brittleness and cracking tendency of the material.

Therefore, with a straight high-carbon steel, it is difficult, if not impossible, to obtain the desired abrasion resistance and hardness and, at the same time, maintain sufficient ductility to withstand impact loads common to hardfacing.

Alloys control the manner in which the carbon occurs in the deposit at any given cooling rate. That is, they determine the grain structure of the material and as a result, control the hardenability and wear resistance of the material.

By substituting other properly selected elements for some of the carbon, it is possible to obtain with the same cooling rate a material which has a wear resistance comparable to that of higher carbon materials.



DRAG line bucket must withstand both abrasion and impact, thus necessitating two types of hardfacing.

In addition, it will retain considerable toughness and ductility. Hence, most hardfacing deposits contain alloying elements.

For a given alloy content, the cooling rate (above about 1,600 F) determines the material's grain structure and controls its properties.

In welding, the weld metal cools from the molten state to room temperature. Normally, this fairly fast rate has little effect on low carbon steel deposits, but frequently has considerable influence on the hardfacing deposits.

The results of fast cooling can be both beneficial or detrimental in hardfacing, depending on the alloy content of the base metal and the deposited metal. Fast cooling often produces a more abrasion resistant deposit than slow cooling.

On the other hand, too fast cooling may produce a brittle heat-affected zone in a high carbon or alloy steel base metal. This creates a tendency for the deposit to spall. Therefore, generally, as the alloy content of the base metal increases, it becomes more necessary to control cooling.

shape if finishing is required. Grinding, of course, also can be used on any of the other deposits.

The in-service function of the hardfacing deposit also influences the selection of hardfacing material:

1 — A single surface to be protected from wear by another material is the function of most hardfacing applications. This includes all earth-moving equipment where wear is caused by the materials handled.

Another application is on water turbine blades, where corrosion is a problem. Thus, electrode selection depends mainly on type of wear.

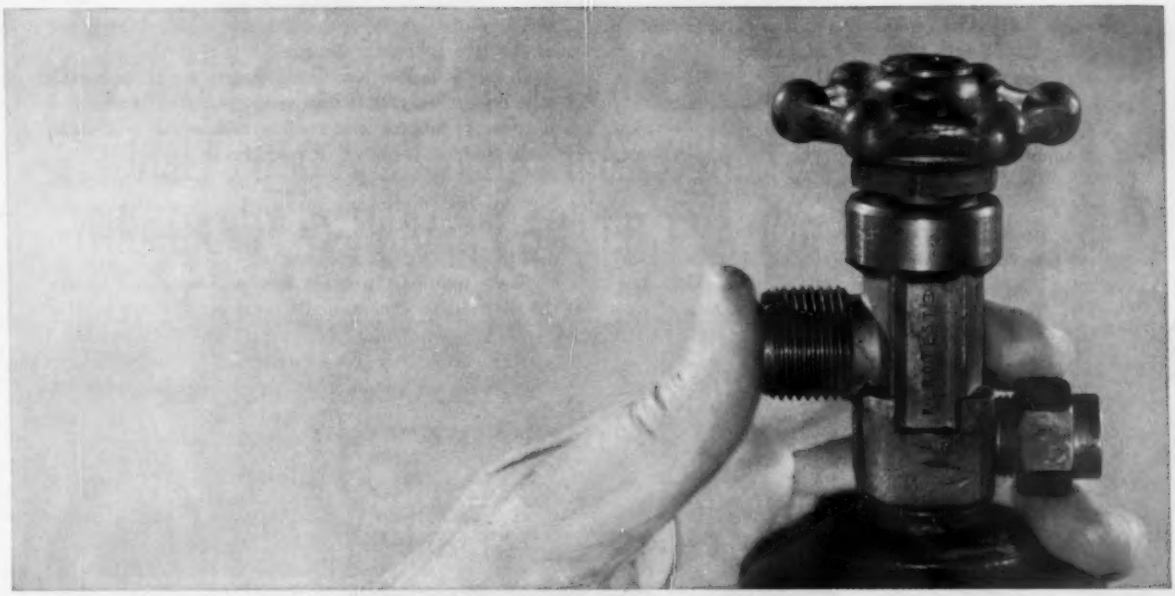
2 — Applications where the function of hardfacing is to protect two metal surfaces in contact with each other include parts ranging from lubricated machine parts to track and rollers on bulldozers.

The straight martensitic electrodes are especially good for this type wear when there is little complication from outside foreign particles such as dirt, grit or other wear-inducing materials. When these particles are introduced, it is best to use a more abrasion resistant deposit, such as semi-austenitic types.

3 — Shear blades, punches and metal cutting tools must not only stay sharp, but must also hold their original size and shape to operate satisfactorily. This requires the special properties of edge strength found in the high-alloy martensitic deposits.

On many applications (plow points, rotary drills, bits, scrapers) cutting-edge wear does not impair part operation. The material may wear back as long as it maintains a reasonably sharp edge.

Basically, this application requires that the deposit



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have good abrasion resistance and that chrome-carbide and semi-austenitic type deposits are made.

The type of wear encountered by the part in service is particularly important in helping select the electrode which will do the best hardfacing job. Each electrode is designed to resist a different type or degree of wear.

When analyzing the job, look for the following:

1 — Abrasion is the most common wear encountered and may be due to grinding action from rubbing against abrasive materials (gravel, sand, clay, soil) or from sliding, rolling or rubbing action of one metal part against another.

Both of these causes may take place under either low or high pressure. Metal-to-metal wear may be intensified by introduction of abrasive particles which add a grinding action to the already existing sliding action.

2—Impact wear results from the repeated pounding by hard rock-like materials in service. It may vary in degree from light to very heavy, and tends to deform the surface or cause cracking or chipping.

3 — Corrosion results from the action of various chemicals on the material, or from oxidation or scaling at elevated temperatures. Even ordinary water may cause many materials to rust away.

In most applications, more than one of the above factors are at work simultaneously, and it is then necessary to evaluate the relative importance of each. The final selection of the hardfacing material frequently becomes a compromise because, generally, electrodes which have maximum abrasion resistance have minimum impact resistance.

Therefore, it is necessary to choose the material which has maximum abrasion resistance, but also has enough impact resistance to withstand inservice pounding on the part.

Composition of the part, in some cases, influences electrode selection, but more frequently it affects the procedure used to deposit the hardfacing metal.

During welding, the part itself undergoes a heating and cooling cycle which influences the properties of the base metal, particularly those in the heat-affected zone.

If the base metal is mild steel, the heating and cooling cycle has little effect on its properties.

However, if the base metal is a highly-hardenable material, its properties will be greatly affected, usually forming a hard, brittle area unless proper procedures are used.

DURING welding, part undergoes a heating and cooling cycle which effects the base metal.

Therefore, all base metals are divided into one of the two following groups:

Group A — Included in this group are those metals whose physical characteristics are not greatly changed because of heating and cooling and which will withstand sudden localized temperature.

Some of these metals are: plain carbon steel with 30% carbon maximum, low-carbon, low-alloy steels, austenitic steels such as the chrome-nickel stainless, and the high manganese steels.

These materials provide few problems and unless the part has an exceptionally large mass, there is little required beyond having parts at room temperature.

Group B — This group includes those metals whose physical characteristics, particularly hardness, may be changed considerably because of welding heat and subsequent cooling, or which will crack with sudden localized application of heat.

Some of these metals are: medium to high carbon steels, tool steels, medium to high carbon alloys, cast iron (gray, white, malleable, chilled), semi-steel, and generally, all hard metals and alloys.

Even mild steel parts which have been previously hardfaced fall into this category if some of the hardfacing still remains.

Some steels are so hard and have so many internal stresses already present before welding begins that the thermal shock from the arc's heat could cause cracking as soon as the arc is struck. The crack may be small, or it may progress throughout the entire part.

In other materials the condition may not be so severe. However, they contain enough alloy so that the heating and cooling cycle produces a very hard, brittle material in the part, particularly in the heat-affected zone.

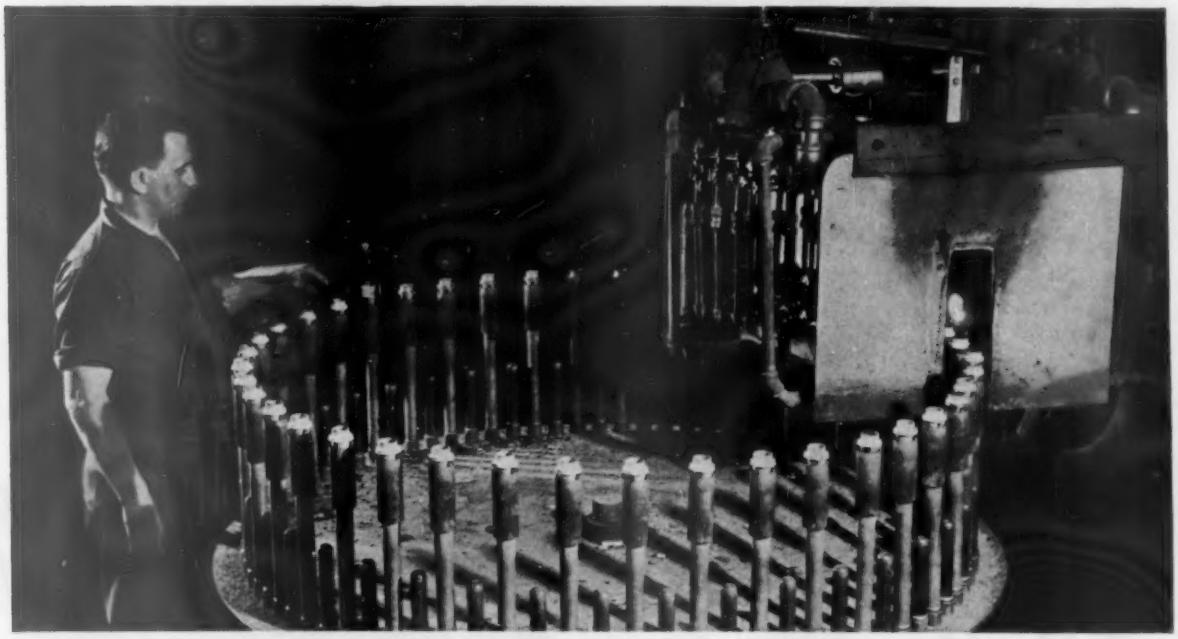
Frequently, these brittle areas are severely stressed by shrinkage of the part and the weld metal during cooling. Sometimes this shrinkage stress alone is enough to cause the brittle area to fail and the weld metal to spall or peel off.

More frequently, however, working stresses on the part add to the shrinkage stresses and cause failure after the part has been put in service.

With proper procedure, almost any part can be hardfaced, but be sure to check the composition of the part as you analyze the entire job. In this way you will know what procedure to use in depositing the hardfacing material.

(A followup on application procedures will appear soon. For a reprint of this article, circle number 250 *on the Welding Info-Aid Card, page* 97.)

Every Hour M. S. Little Brass Goods Company Makes 650 Appliance Fittings Better With **HANDY & HARMAN SILVER BRAZING**



Rotating jig showing mounted assemblies entering and leaving gas-air furnace.

Left– brazed assembly. Right– components with preform ring of EASY-FLO *45.*

This Hartford, Connecticut, company makes—in volume—an assembly that goes into the overflow system of household appliances. The assembly consists of brass tubing and a machined brass casting. The two components are joined by a preplaced ring of Handy & Harman EASY-FLO 45 silver brazing alloy and HANDY FLUX. Heating is automatic gas-air; parts are placed on a rotating turntable to pass through the gas furnace. Every 60 working minutes, 650 assemblies are completed.

The advantages here are that the manufacturer can use thin-walled tubing with heavier, threaded components at no sacrifice in strength. Because of EASY-FLO's penetrating qualities, the entire shear area is fully as strong as the solid parts of the assembly, yet considerably lighter. And, casting and machining the components for this assembly have been greatly simplified.

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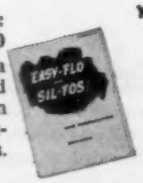
FOR A GOOD START: BULLETIN 20

This informative booklet gives a good picture of silver brazing and its benefits... includes details on alloys, heating methods, joint design and production techniques. Write for your copy.



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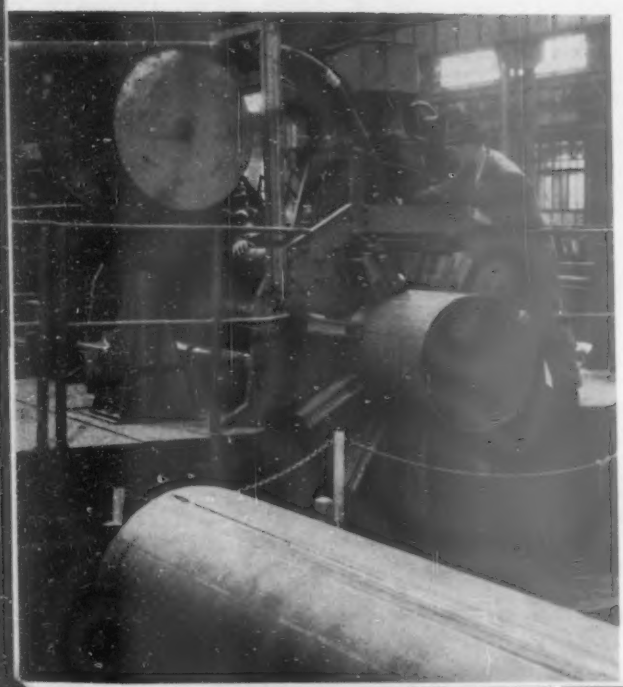
On the job . . .

NICKEL-SILVER brazing alloy, made by All-State Welding Alloys Co., Inc., White Plains, N. Y., and an oxyacetylene torch for in-place build-up of gear teeth saved over $2,600 in materials, freight, disassembly and assembly of new gear. Result was overlay of 200 Brinell hardness on work-hardening.



GIANT-SIZE tubes are submerged arc welded at one of the plants of Phoenix-Rheinrohr A.G., Dusseldorf, West Germany. The West German steel and pipe manufacturing company has annual sales of approximately $400,000,000 and employs 33,000 persons.

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Basic metallizing applications listed

Question:

We are considering the use of metallizing to protect our steel tubing. Could you give some basic information to help us determine if this is feasible for our operation?

Answer:

Industrially, metallizing — or metal spraying — consists of two separate and distinct areas, each with hundreds of applications.

The two basic areas are (1) mechanical and maintenance and (2) corrosion resistance.

In addition to these basic areas, metallizing is employed extensively in special production applications involving automatic or semi-automatic handling, as well as for the application of decorative metallic coatings to a variety of materials.

The process consists of building up the surface of an object by blowing small particles of molten metal against it in a blast of air

The metal is usually melted by an oxyacetylene torch equipped with a device for feeding a wire of metal into the flame at a constant rate. The torch blast blows the molten material into a fine mist and carries the mist to the object to be coated.

Other types of equipment feed the metal into the flame as a fine powder of premelted liquid.

The metal will adhere to a properly prepared surface, even if the surface is not brought to the welding temperature, and organic materials can be coated without damage if they are moderately resistant to heat.

Any metal which can be melted in the torch flame can be sprayed for metallizing.

Many types of fuel gases can be used. However, acetylene and propane are most common.

According to the National Safety Council, metallizing is used as a method of tinning, galvanizing, copper or cadmium plating or hardfacing.

It is probably most commonly used as a maintenance process to build up worn shafts (see photo), rolls, wheels, or other parts with noncorrosive or hard metals such as stainless steels, monel, and hardfacing alloys.

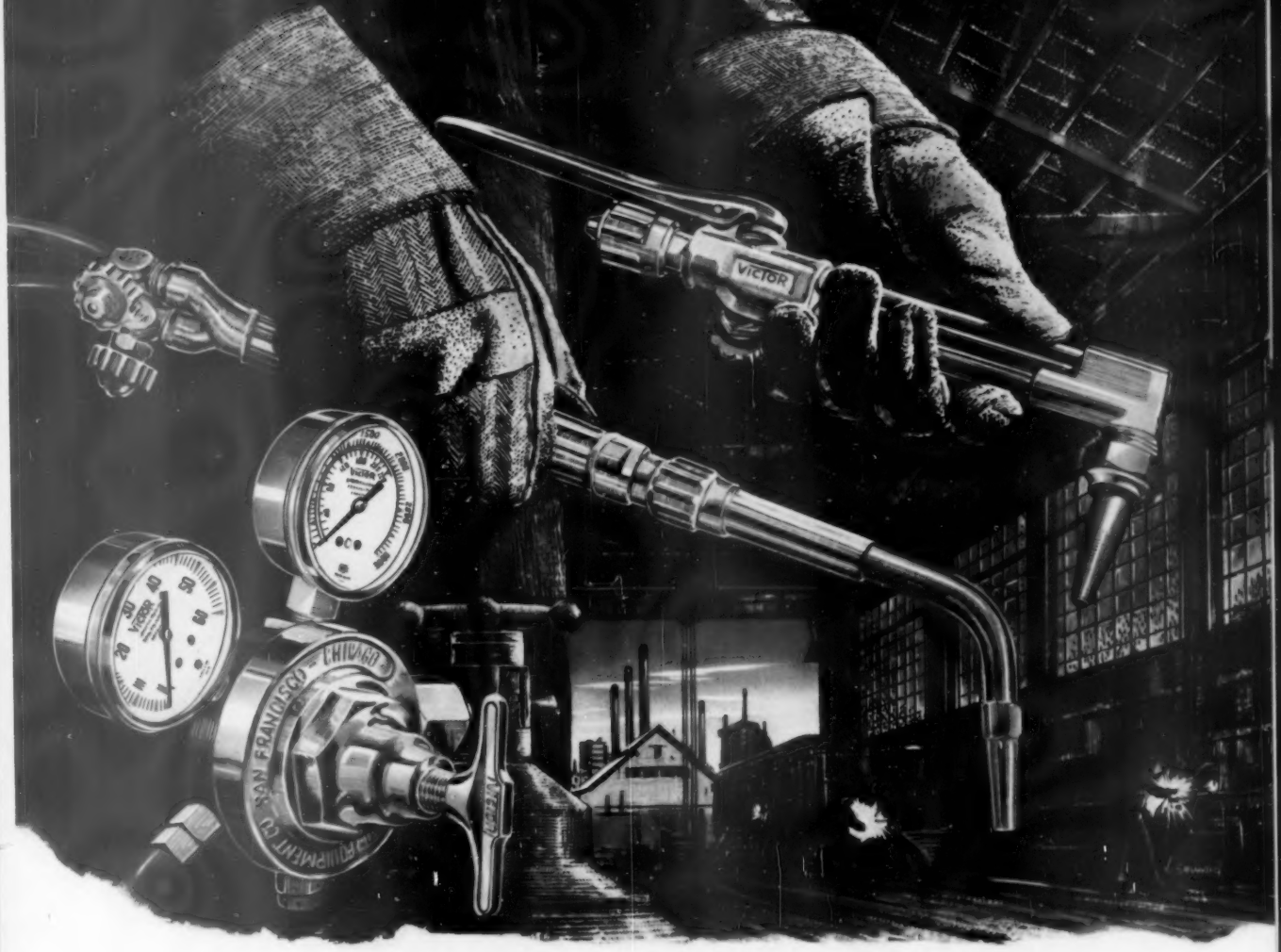
Metallized coatings of zinc and aluminum are used extensively to protect iron and steel against water and atmospheric corrosion and to prevent product contamination. Aluminum coatings, nichrome coatings and those of certain oxides are applied to protect steel from scaling at high temperatures.

In addition, metallized coatings are used for decorative purposes, contact points, electrical circuits, grounding or shielding and similar applications

Combined with organic sealers metalized coatings are used to protect metals against corrosive attack from salt water, fresh water, acids and other chemicals.

WORN areas of large diesel crankshaft are built up by metalizing with stainless steel.

For more facts Circle No. 197 on Welding Info-Aid Card →



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79

JOSEPH HOLT completes inspection of one of the last beams flame-straightened at a ballistics missile warning station in Clear, Alaska. Note heat marks on flame-straightened beams.

Oxyacetylene torch process saves over two months in repairing structural members of computor building at Ballistic Missile Early Warning System station in Alaska.

Flame-straightening restores fire distorted steel

FLAME-STRAIGHTENING WAS CALLED upon to restore distorted structural steel when fire occurred at a ballistics missile warning station in Clear, Alaska, exactly one year ago.

The Air Force sent for Joseph Holt of Snohomish, Wash., to restore six damaged bays of the computor building of the Ballistic Missile Early Warning System station.

In 1958, Holt had saved the government money and valuable time by straightening fire-damaged structural steel at a hangar at McChord Air Force Base near Tocoma, Wash. (See *WE*, Feb. 1959, page 40.)

At the Clear, Alaska, fire a total of 250 structural steel members were severely distorted. Some deflections were as little as 4 in. on shorter members, but some longer members showed 3-ft lateral deflections.

According to structural steel engineers, at least 30% of the damaged members had to be replaced, but remaining members could be reused if they could be straightened. Replacement of all damaged steel beams was estimated at $200,000. Estimated delay for repairs to the building, which was over half done when fire occurred, was three months.

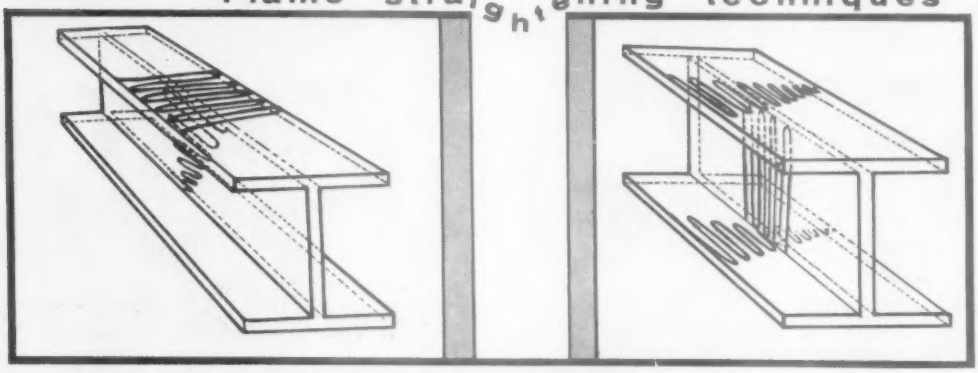
Originator of the flame-straightening process, Holt decided to repair damaged members in place to save disconnection and removal time. Repair was completed in 22 days.

Tools for the project consisted of an oxyacetylene heating torch with a heavy-duty tip for applying maximum heat in concentrated areas, and a hydraulic jack mounted on a post for exerting constant force on the beams being straightened.

Two crews composed of men with no previous flame-straightening experience were used. One crew worked under Holt and the other under his son, Fred. The crews worked in 9-hr shifts.

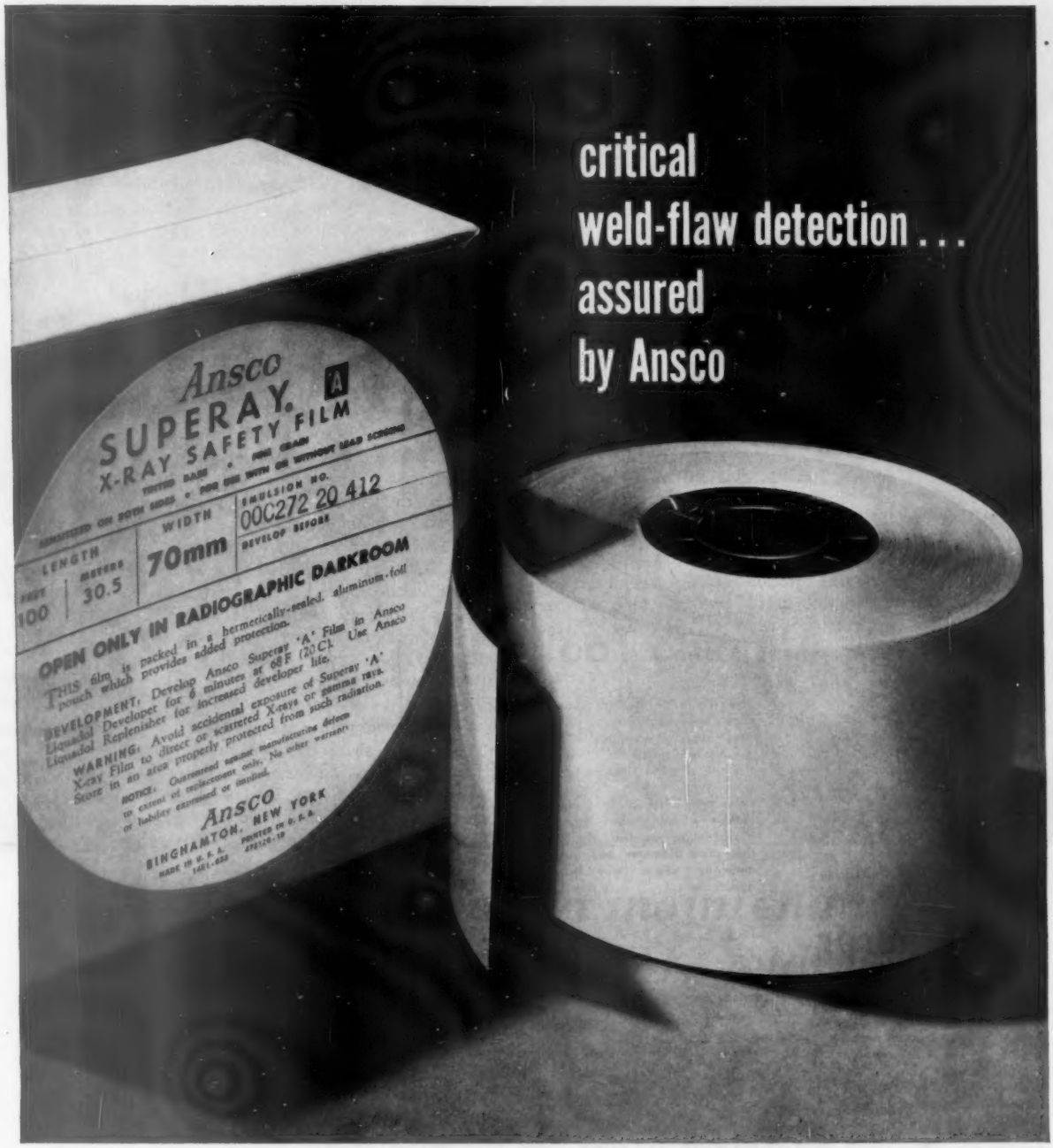
Each crew consisted of three welders, four laborers and the two supervisors. The only material

Flame straightening techniques



EDGE-WISE BENDING is accomplished by heating I-beam web in a vee-shape toward one set of flanges and then continuing heat on flanges.

SIDE-WISE BENDING is accomplished by heating webb of I-beam to be bent to the same width as on the flanges where they join the web.



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The Jumbo Radius Marker is also the folding type, has a span of 48" and easily swings a 96" circle. These tools are precision made of rust proof aluminum Jural.
The Standard Radius Marker folded, measures only 9½" in length, weighing only 8 oz. The Jumbo model, of course, is larger. Both are equipped with special spring washers to maintain accuracy and rigidity for years of service. Pencil holder is made to hold round or flat pencils, soapstone, or steel point.

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Flame-straightening (continued)

expended was 160 cylinders of acetylene and 200 cylinders of oxygen.

To straighten a beam vertically bent (with the top flange concave and the bottom convex) heat was applied to the beam web beginning about 1 in. below the top flange and extending to the bottom flange. The heated area thus became wedge-shaped with greater bottom width.

The heat application points were selected carefully. First, heat was applied near ends with the tangency point between the straight and curved section. This area was then uniformly heated at a temperature below the glow point.

After the heated metal cooled, the tangency point moved toward the center and heat was again applied at the new point of tangency. The number of heat applications depended on the degree of distortion.

The straightening involved a contraction of the elongated side of each beam causing an upsetting action which resulted in steel with a finer metallic grain structure than prior to heating.

During the cooling of one beam, the crew moved and applied heat to an adjacent beam so no time was lost. Load tests on four representative beams indicated that straightening did not in any way effect the steel's elastic property. All beams showed normal deflections and recovery.

The savings in time and money which the flame-straightening method has shown indicates a potential value in industrial use.

One possible use is in straightening damaged bridge members without interference to traffic. In a national emergency, the salvage value of the operation is immeasurable.

Essentially, flame-straightening is a studied application of the simple fact that metal expands on heating and contracts on cooling. Using only an oxyacetylene torch, a flame-straightening expert can reshape steel parts that seem irreparable.

Holt has this to say about the process:

"Steel expands or contracts in a definite ratio to each degree of temperature change. A reasonably accurate scale allows for an expansion or contraction of 1/8 in. per foot of heated metal, if this metal receives the amount of heat necessary for a blacksmith's forge weld.

"The method of applying heat must be such that steel, instead of expanding in length, will expand into itself. To make this method work, there must be portions of the member cold enough, strong enough and so situated as to force "inward" contraction where heated unless outside force can be added."

Unfortunately, though its principles can be explained and examples of its application cited, flame-straightening is not a "pat" subject for definition. It is a skill best used by men who have studied its effects in a multitude of diverse applications.

For more facts Circle No. 199 on Welding Info-Aid Card

For more facts Circle No. 208 on Welding Info-Aid Card →

Boscobel weldor is attaching Jalloy #1 steel wear plates to Bucyrus Erie alloy body and manganese steel lip with Wear-O-Matic WH wire.

35% *Savings on bucket maintenance with NEW Wear-O-Matic WH welding wires*

"Wear-O-Matic WH is the most versatile welding wire for bucket maintenance because it provides high strength welds in any of the popular alloy steels and has excellent resistance to impact when used for build-up work. Savings in time and labor through the semi-automatic open arc application of this wire have resulted in less bucket down time and lower costs."

L. ARDEN HENLEY, SUPT.
BOSCOBEL GRANITE CORP., MANAKIN, VA.

WHAT about bucket maintenance in your shops? Costs too high due to too many manual welding applications? The important benefit gained by Boscobel Granite was the elimination of manual welding with stainless steel electrodes to obtain the necessary high strength attachment welds for their rugged rock handling chores. These benefits can be yours whether you are welding manganese to manganese, manganese to carbon steel or either of these to any of the abrasion or impact resistance alloy steels. Then, without changing wires, your weldor can apply build-up deposits to lesser worn areas such as latch pins, keepers and lips . . . a deposit that will work harden to outwear manganese steel. To put more service life in the business end of your shovels and drag lines, investigate today the semi-automatic open arc application of Wear-O-Matic WH wires. You'll lower your maintenance costs . . . decrease down time and increase working life. For complete details, request Bulletin AR-21. Alloy Rods Company, P. O. Box 1828, York 2, Pa.

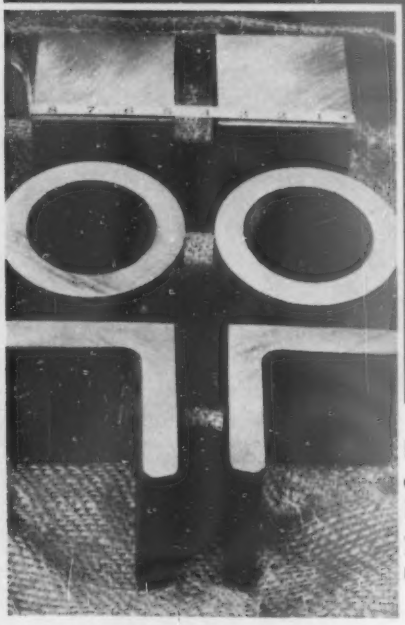
ALLOY RODS COMPANY

YORK, PENNSYLVANIA

SALES OFFICES & WAREHOUSES; BOSTON, NEWARK, PHILA., PITTSBURGH, BIRMINGHAM, CLEVELAND, CHICAGO, SAN FRANCISCO & EL SEGUNDO, CAL.—DISTRIBUTORS IN ALL OTHER PRINCIPAL CITIES

TWENTY YEARS OF LEADERSHIP IN THE DEVELOPMENT OF QUALITY ALLOY ARC WELDING ELECTRODES

These 6 finely finished surfaces required only



3!

operations

or just

1/2

operation

per end.

How do you do jobs like this in your shop now?

And in the process the metal was also severed or CUT AT THE SAME TIME.

24 seconds to cut the 2 squares
20 seconds to cut the 2 tubes
12 seconds to cut the 2 angles

OR

less than *one minute* for the whole job —

Cut 3 pieces! And also finish 6 ends at the *same time.*

Can you afford not to investigate?

Write or phone COLLECT to Klaus von Frantzius.

BUckingham 1-7000

Ask for information about "Cut-Machining"

WALLACE

SUPPLIES MFG. COMPANY

1810 W. Cornelia Ave. • Chicago 13, Illinois

Reprints still available from WE

Reprints of certain articles published in Welding Engineer are still available. A list of these appears below. Reprints may be obtained for 15 cents each, except where otherwise noted. Payment must accompany all orders. For quantity orders, write for special prices. Order by title from: Reprint Editor, Welding Engineer Publications, Inc. Box 28, Morton Grove, Ill.

Fundamentals of wear resistant overlay
Explains causes of metal deterioration and how to avoid it and how to select a welding process for hardfacing. This reprint 25¢ each.

Techniques for torch brazing aluminum
Procedures and techniques for brazing aluminum, are detailed. Includes data sheet on brazability of aluminum alloys plus four tables listing commercial products and their characteristics. This reprint is free.

Design for welding
Basic knowledge required when designing or redesigning for welded construction is detailed and discussed. Sixteen page reprint includes 11 data sheets.

The meaning of weldability
Weldability of carbon steels and alloy steels, as well as some other metals, is discussed. Sixteen page reprint includes three data sheets.

How to weld T-1 steel
Explains how to weld this high-strength low-alloy metal. Includes a data sheet on T-1 mechanical properties.

Fundamentals of oxyacetylene welding
Gives the basic essentials on and primary steps of oxyacetylene welding.

Welding of dissimilar metals
Complete details on welding dissimilar metals using NiCrFe electrodes and wires. Eight page reprint includes charts on properties test results and data sheet on properties of other metals.

Acetylene
A 12 page salute to the IAA and acetylene, details the great success of this gas. Includes a history of the IAA and "The Acetylene Journal."

Fixtures for brazing
Presents requirements for designing brazing fixtures and materials to be used. Data sheet on properties of non-metallic fixture materials included. Free.

Filler metals for brazing
Brazing filler metals are detailed and each group is analyzed. Includes data sheet on how to select silver brazing alloys.

Production welding controls
Discusses how material, labor and overhead effect total production welding costs, and how certain controls can result in greater time and dollar savings. This reprint is free.

New aluminum alloy not prone to brittle fracture
Extensive testing of 5083 aluminum alloy proves it has excellent weldability and weld ductility, and a good resistance to corrosion and stress corrosion. Testing for brittleness is detailed. This reprint free.

(*Continued on page* 86)

New weldable 18% nickel steel has high ductility

Achieves yield strength in excess of 250,000 psi

A NEW READILY-WELDABLE 18% nickel alloy steel with exceptional toughness at the highest strength levels of traditional alloy steels has recently been developed.

The alloy was discovered by scientists of The International Nickel Co.

With either manual or automatic welding, sound crack-free welds can be achieved on the 18% nickel steel, even on material in the fully heat-treated condition, without preheating.

Post-weld mar-aging — heat treatment involving age-hardening of martensite — restores the softened heat-affected zone of the parent plate to full strength and establishes properties in the weld metal closely approaching those of the base plate.

The mar-aging treatment consists of holding the alloy for about three hours at 900 F and air cooling. Solution annealing at 1,500 F prior to mar-aging is optional. Quenching is not required, and full properties can be developed in heavy sections with no distortion problems.

This new nickel steel (18% Ni, 7% Co, 5 Mo, less than 0.5% Ti, maximum of 0.05% C) is the only known material which can achieve a yield strength in excess of 250,000 psi while maintaining a nil ductility temperature below -80 F, according to Inco.

Another outstanding characteristic of the alloy is its notched tensile strength which exceeds 400,000 psi (measured with a notch radius of 0.0005 in.). Tests also show that the new alloy possesses high resistance to delayed cracking when exposed to severe corrosive atmosphere in a highly stressed condition.

ATLAS | WIDE-BLADE TOMAHAWKS

WORLDS LEADING WELD CLEANING TOOLS

Handle raised for a quick grip!

THE NEW ATLAS "EASY-GRIP"!

WITH "WIDE BLADE" THAT SPEEDS THE JOB

This is our economy tool—yet it has all these famous Atlas features: (1) Forged head of chisel steel with 18% wider blade for faster work with less effort. (2) Head can't come off or turn on shaft. (3) One piece steel shaft and grip that can't burn or splinter and lasts as long as the head . . . You'll like both the "feel" and balance of this husky, quality Atlas Tomahawk and you'll like the price, too! It is available in three models: cross chisel and cone, chisel and cross chisel, chisel and cone. At the price you can own the set of three and be prepared for any job that comes along.

Tough as they come!

33 MODELS

Each Atlas tool is made as well as we know how. Ask your welding supply dealer to show you the complete line.

ATLAS WELDING ACCESSORIES INCORPORATED
707 E. LEWISTON
FERNDALE 20, MICH.

For more facts Circle No. 210 on Welding Info-Aid Card

Your name . . . slogan . . .

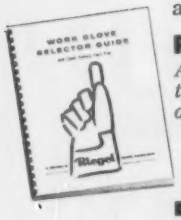
IMPRINTED FREE!

on

Riegel

gloves

What better place for a safety slogan than right on hand . . . always. Your slogan or company name can be printed on the backs or cuffs of Riegel gloves . . . free on any style. Emblems for just the slight cost of engravings. It's another Riegel extra. Try Riegel gloves now . . . compare for comfort and wear. You'll agree Riegel means uniform top quality at competitive price. Write for



FREE GLOVE GUIDE

A wealth of information: styles, types, materials, chemical resistance, case histories, and more.

WRITE: GLOVE DIVISION
RIEGEL TEXTILE CORP.
Conover, N. C.

WELDERS GLOVES

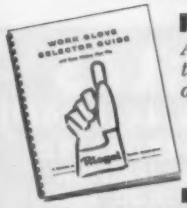
by

Riegel

Horsehide glove shown

. . . Cool comfort!

Need a rugged glove with lots of finger action? Need extra heat protection? Need a light glove? Doesn't matter . . . there's a Riegel Welders glove or mitten just for you. Finer gloves at competitive cost: special tanning, seamless back, wool lining, and welted seams. To help select the *right* glove for your job, write for



FREE GLOVE GUIDE

A wealth of information: styles, types, materials, chemical resistance, case histories, and more.

WRITE: GLOVE DIVISION
RIEGEL TEXTILE CORP.
Conover, N. C.

Reprints Available

(*Continued from page 84*)

Explosive welding and forming open another door

A report on one of the newest entries into the welding industry, and how one pioneer company turned theories and practices into realities.

Our modern-day mythology

A rebuttal to some old-wives tales about the hazards of welding fumes, plus safety recommendations for situations where hazards might develop.

Welding the reactive metals

This 12-page reprint describes techniques for Tig welding titanium, zirconium and tantalum. It also gives experimental data on resistance spot welding of tantalum.

Welding 17-4 PH stainless steel

Sound joints can be easily produced in 17-4 PH stainless by proper welding practice. This 4-page reprint details all phases of the procedure.

Welding thoriated magnesium

Development of specialized machinery and techniques for joining new magnesium alloys, especially thoriated types, has aided in the production welding of such materials. This 4-page reprint includes tables on mechanical properties and on weld defects and how they affect weld strength.

Instructions for welding moly

Molybdenum has a melting point of 4,730 F, which makes it ideal for high-temperature service in planes, missiles and nuclear reactors. This report gives welding data resulting from six years of experimental work sponsored by the Office of Naval Research. This reprint free.

Effect of arsenic on welds

A study of arsenic's effects on the mechanical properties of welds in mild steel was directed specifically toward a determination of arsenic's role in behavior of welding fittings. Results are revealed in this 4-page reprint.

Stress relieving

Stress relieving can be an important manufacturing operation or a needless expense item. This 4-page reprint is intended to help you in making a correct decision in the matter.

Uses of build-up electrodes

As rebuilding and reclaiming of worn steel parts becomes standard maintenance procedure, build-up electrodes increase in importance. This 2-page reprint lists the qualities necessary for a good build-up material.

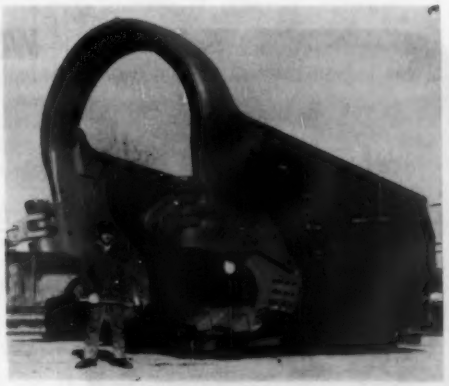
A guide to preheat

This 4-page reprint on benefits of preheat includes an engineering data sheet entitled "Recommended preheat for steel alloys."

Non-destructive testing

Four separate articles comprise this 8-page reprint on non-destructive testing: how to interpret radiographs; circumstances and job requirements govern selection of radiation source in inspection; ultrasonic testing; and a program for radiation safety.

In Summary . . .



The biggest drag bucket ever put in service (see cut) is ready for its first assignment stripping overburden, at 35 cubic yards a bite, from an open pit mine in Brazil. The welded scoop, fabricated from 5-in.-thick steel plate, was made by **Esco Corp.**, Danville, Ill. . . .

Electric hammers made by **Black & Decker Mfg. Co.**, Townson, Md., which are purchased from Feb. 26 through June 30, 1961 carry a certificate giving free one-year repair service . . . **The Circo Equipment Co.**, Rahway, N.J., has delivered one of the largest automatized ultrasonic flaw detection scanning systems ever developed to **Pratt & Whitney Div.**, West Hartford, Conn. It will be used for missile and aircraft parts testing . . .

Linde Co., New York City, has completed the first on-site plant designed to produce high-purity oxygen for conversion to ozone. The plant is located at **Emery Industries, Inc.**, Cincinnati . . . The Western Plant Maintenance & Engineering Show will be held in Los Angeles' Pan Pacific Auditorium, July 18-20.

O'Neil-Irwin Mfg. Co., Lake City, Minn., has changed its name to **Di-Acro Corp.** effective immediately . . . **T. W. Smith Welding Supply Co.** has relocated at 544 W. 53rd St., New York City . . .

National Electronics, Inc., Geneva, Ill., is offering a 23-page booklet titled "Industrial Tubes by National" on practical electronic equipment maintenance. Booklet can be procured for 25¢ from the firm . . . A two-day open house was held recently by **Hartwick Welding Supply Co.** to introduce its new facilities at 3700 Buchanan Ave., SW, Grand Rapids, Mich. . . .

A new fluidized bed furnace (see cut) to produce extremely fast and uniform heat has been developed by **Boeing Airplane Co.**, Seattle, Wash. The furnace will be produced and marketed by a subsidiary of **The Electric Furnace Co.**, Salem, Ohio. . .

The American Hot Dip Galvanizers Association, with the cooperation of the **American Zinc Institute**, will offer 10 awards of $1,000 each for ideas developing new applications and markets for hot dip galvanizing. . . . **Olin Mathieson Chemical Corp.**, New York City, has launched a new national $2½ million corporate advertising campaign.

Pullman-Standard Div., Chicago, has signed an agreement with **Matisa Equipment Corp.**, Chicago Heights, Ill., under which Matisa will act as sole agent for Pullman's railroad track maintenance machines in the United States . . . Corporate headquarters of **Gregory Industries, Inc.**, have been moved to 811 Madison Ave., Toledo, Ohio.

"Our weldors sure do like to work with that new Murex AC machine..."

That's what everybody seems to be saying wherever the M&T Murex AC Industrial Arc Welder gets put on the job. No wonder. It's designed for easy handling and dependable service, with . . .

Just one inch of shunt travel for entire current range. Rigidly mounted shunt for quiet, chatter-free operation. Fast, single crank heat control. Patented dual-coil transformer in a balanced circuit for smooth, steady arc under all welding conditions. High open circuit voltages for instant starting of arc with all types of electrodes.

Write for data sheet. METAL & THERMIT CORPORATION, General Offices, Rahway, New Jersey.

MUREX

AC ARC WELDER

WE May Headlines

. . . from page 8

Thyratron tube is "self testing"

A new "self-testing" thyratron tube which indicates its condition and eliminates the necessity of removal for testing has been described in a paper by W. A. Maijala and A. J. Humphrey of Reliance Electric and Engineering Co., Cleveland.

The new device, which allows testing of the thyratron while it operates in its actual circuit, eliminates handling damage and permits full lifetime use.

NEMA studies unconventional generation

A section on unconventional power generation has been formed by NEMA.

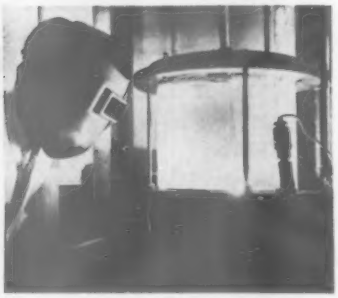
The new section will deal with magnetohydrodynamics (MHD), fuel cells, theroelectrics, thermionics, batteries, photovoltaics and photochemicals.

A five-man program committee, headed by Dr. Manfred Altman, consulting engineer of the Missile-Space Vehicle Department of General Electric Co., will prepare recommendations for proposed section activities.

New welding firm

THIS building at 1505 E. Eight Mile Rd., Hazel Park, Mich., houses the newly-formed Weldmation, Inc., which will design, and manufacture all types of automated resistance and arc welding machinery for the sheet metal fabricating industry. President of the new corporation is Arthur F. Kelsey.

Rhenium production



METALLURGIST at Chase Brass & Copper Co., Waterbury, Conn., melts rhenium-molybdenum alloy compacts into test bars using a tungsten arc furnace. The melting is part of the first commercial production of rhenium-molybdenum alloys.

Chase Brass forms rhenium division

Chase Brass & Copper Co., Waterbury, Conn., has formed a Rhenium Division. John H. Port has been appointed manager of the new division.

Chase Rhenium Sales have increased approximately 400% over the past four years.

Semiconductor begins distributor program

Semiconductor Division of Syntron Co., Homer City, Pa., has inaugurated a nationwide industrial distributor program.

Under the program, distribution of the division's full line of rectifiers will be made through qualified jobber distributors in all major domestic marketing areas.

Welding in Hawaii

NEW welding and cutting methods were demonstrated recently in Honolulu, Hawaii, for more than 100 metal fabricating representatives. Demonstrations were conducted by Lee Reay (at far left above), sales promotion manager for Linde Co., New York City.

Circle No. 212 on Info-Aid Card

Magnetic Ground Clamp

On and Off in seconds . . . No awkward clamps, screws or springs needed to hold ground to work.

Rugged aluminum body makes for improved electrical contact; ground remains cooler, thus increasing efficiency of welder.

A great time-saver . . powerful, long-lasting built-in Alnico magnets produce a vise-like grip that holds the ground hog to work in any position . . . on flat, round or angular surfaces.

LIST EACH $7.95

Distributor territories still open.

MAGNE CAST TOOL CO., Inc.
4614 WEST 5TH AVE. • CHICAGO 44, ILL.

QUIK-HEAT

up to 2200° F.

CLEMENTS Cadillac

MODELS K3 & M2
BLOWTORCHES

Here are rugged, high efficiency blowtorches that speed up all types of heat treating and production operations. These two Clements Cadillac Blowtorches provide heat up to 2200°F, in seconds and are fully portable.

With the Clements Cadillac model K3 or M2 you can bring the torch to the work instead of the work to the torch as in fixed installations. Furnished fully equipped with 20 ft. of Underwriters' Laboratories and Canadian Standards Association approved 3-wire cable with plug, 10 ft. of gas hose with fittings ready to attach to your gas line and with sturdy, high stability stand. Easily adjustable for height and direction of torch.

Operates on natural, manufactured, or LP-gas.

CLEMENTS MFG. CO.
6645 S. Narragansett Ave., Chicago 38, Ill.
SINCE 1910
INDUSTRIAL PRODUCTS DIVISION

Circle No. 213 on Info-Aid Card

ASM authorizes extension diplomas

An extension-diploma program has been authorized by the trustees of the American Society for Metals for its home-study division, Metals Engineering Institute, Novelty, Ohio.

Extension diplomas will be awarded for completion of a prescribed sequence of 5 of more than 20 metallurgical courses offered.

Wheelabrator opens Canadian firm

Wheelabrator Corp. of Canada, Ltd., has been named to succeed the Canadian Division of Wheelabrator Corp., Mishawaka, Ind.

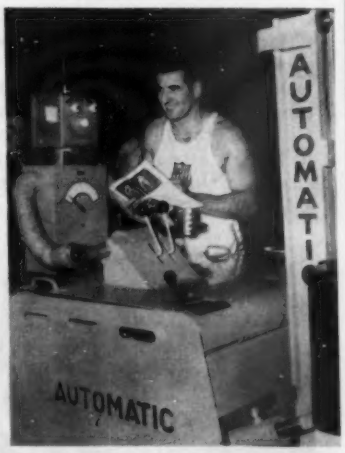
Harold Miller is president and Robert A. Campbell is vice president and general manager in charge of Canadian operations.

Allis-Chalmers gets plasma jet contract

North American Aviation, Inc., El Segundo, Cal., has awarded a contract to Allis-Chalmers Mfg. Co., Milwaukee, for the design and construction of a 1-mw plasma jet test stand facility.

The new facility will generate plasma by electrically heating gas causing it to ionize.

Bragg and friend



DON Bragg, Olympic champion and world record holder for the pole vault presents his autograph to Mr. Otto-Matic, radio-controlled robot who operated the fork lift truck to help measure the bar at the recent Annual Chicago Daily News Relays. The radio-controlled truck, made by Automatic Transporation Co., Chicago, is designed for use in contaminated areas.

"We're using M&T's new DC machine ...it's the best we've seen, and we looked..."

And if *you* look and compare, you'll concur. The Murex 3-phase DC Welder offers the type of rectifier that works best for this service; and it features a design that simplifies operation, makes life easy for the weldor.

Silicon diodes, hermetically sealed, are non-aging and give as much as 98% efficiency. Electrical circuit is designed for instant recovery voltage so that arcs are easily struck, stabilized, and maintained. Simple knob and selector make control of heat and polarity very easy.

Write for data sheet. METAL & THERMIT CORPORATION, General Offices, Rahway, New Jersey.

M&T MUREX
DC WELDER

"I hear the Muretran* welder can handle any type of welding... man, is it engineered!"

Word gets around fast. M&T's "Muretran" Welder is the most versatile ever developed for its field of application. Look at this array of features:

Suitable for manual, automatic, inert gas (MIG, TIG), and spot welding—with quick changeover from one to the other. Plug-in timers for gas pre-flow, post-flow, high frequency drop-out, spot arc. Patented, dual windings in saturable shunt transformer. Sealed non-aging silicon rectifiers for highest efficiency. Want to hear more about M&T's welders?

Write for data on AC-DC and AC units. METAL & THERMIT CORPORATION, General Offices, Rahway, New Jersey.

*Trademark

M&T MUREX MURETRAN All-Purpose WELDER

VIPs in review . . .

John T. McCann has been named executive vice president of the Mechanical Contractors Association of America, Inc., New York City. McCann was formerly director of industrial relations for the General Bronze Corp.

Fansteel Metallurgical Corp., North Chicago, Ill., has named **Leonard K. Adams** director of export activities. Adams was formerly export sales manager.

Bruce Walker succeeds **Joseph S. Imirie** as general manager of the Electro Minerals Div. of The Carborundum Co., Niagara Falls, N.Y. **Dr. Donald W. Gillmore** succeeds Walker as manager of the division's technical branch.

G. Douglas Davis has been appointed manager of new product and market development at The Bastian-Blessing Co., Chicago.

James F. Galbraith has been appointed manager of electric welding development and planning for Linde Co., New York City. Galbraith will direct all technical aspects of the firm's electric welding program as well as planning.

Galbraith

Robbins

James R. Robbins has been appointed product line manager of electrodes and brazing for the Westing-Arc Dept. of Westinghouse Electric Corp., Buffalo, N. Y.

H. D. Clark has joined the Alloy Rods Co., York, Pa. Clark will handle sales in New England and will headquarter at the firm's Boston area office in Waltham, Mass.

Clark

Boucher

The Lincoln Electric Co., Cleveland, has named **A. F. Boucher** general sales manager. He advances to his new position from assistant general sales manager. Lincoln has transfered **Samuel R. Evans** from Philadelphia to the Buffalo, N. Y., sales territory.

Norman P. Gentieu will serve as advertising manager for Foote Mineral Co., Philadelphia, succeeding **John W. Donahey** who has assumed new duties as manager of marketing services and sales promotion.

Joseph H. Buerger, Jr., has been appointed director of sales and **Robert M. Simpson** has been appointed assistant director of sales for the Crucible Steel Co. of America, Pittsburgh.

Irving Edelson has been elected vice president in charge of sales for Sandler Medical Gases, Inc., and Sandler Air Products, Inc., both of Maspeth N. Y.

Howard E. Doyle has been named regional manager in the north central states area for Eutectic Welding Alloys Corp., Flushing, N.Y. Doyle has been with Eutectic since 1953.

Tempilstik°

*temperature indicating crayons**

**Also Tempil° Pellets and Tempilaq° (liquid form)*

Tempilstik°—a simple and accurate means of determining preheating and stress relieving temperatures in welding operations. Widely used in all heat treating—as well as in hundreds of other heat-dependent processes in industry. Available in 80 different temperature ratings from 113°F to 2500°F . . . $2.00 each.

Send for free sample Tempil° Pellets. State temperature desired . . . Sorry, no sample Tempilstiks°

Most industrial and welding supply houses carry Tempilstiks° . . . if yours does not, write for information to:

WELDING SALES DIVISION

Tempil° CORPORATION
132 West 22nd St., New York 11, N. Y.

Circle No. 214 on Info-Aid Card

John F. Spaulding, president of Skil Corp., Chicago, has also become chief executive officer of the firm as a result of a change in the corporate by-laws approved by the board of directors.

O. B. J. Fraser has recently retired from The International Nickel Co., Inc., New York City, under the firm's retirement system. **F. L. LaQue,** vice president and manager of the development and research division of International Nickel has been appointed as one of three representatives of the American Society for Testing Materials on the standards council of the American Standards Association.

Robert L. Lacy will cover the mid-western region of the United States as a hardfacing specialist on the sales staff of Alloy Rods Co., York, Pa.

Robert G. Thompson has been named midwestern regional manager of The M. W. Kellogg Co., New York City. Thompson will be in charge of the firm's new office of its Power Piping Div. in Chicago.

The board of directors of The Black and Decker Mfg. Co., Towson, Md., has elected **Robert C. Tyo** vice president of DeWalt operations. Tyo was recently elected president of DeWalt, Inc., Lancaster, Pa., a Black & Decker subsidiary.

George C. Christy has been appointed technical sales representative for the midwest district of the Iron Powder Div. Alan Wood Steel Co. Conshohocken, Pa.

Edward M. Blanchard, treasurer of Arcos Corp., Philadelphia, has been elected a director of the Controllers Institute of America.

Donald Schaefer will manage welding electrode production, sales and research as welding division manager for The Champion Rivet Co., Cleveland. Also at Champion, **E. J. Markert** has been appointed vice president of manufacturing and **William F. Dempsey** is now forging division manager.

"Mighty convenient to get all our welding accessories with just one call to M&T..."

A one-stop supply source for every arc welding need—that's M&T. The Murex line of accessories is wide. It offers the finest quality to be had. It assures you proper service.

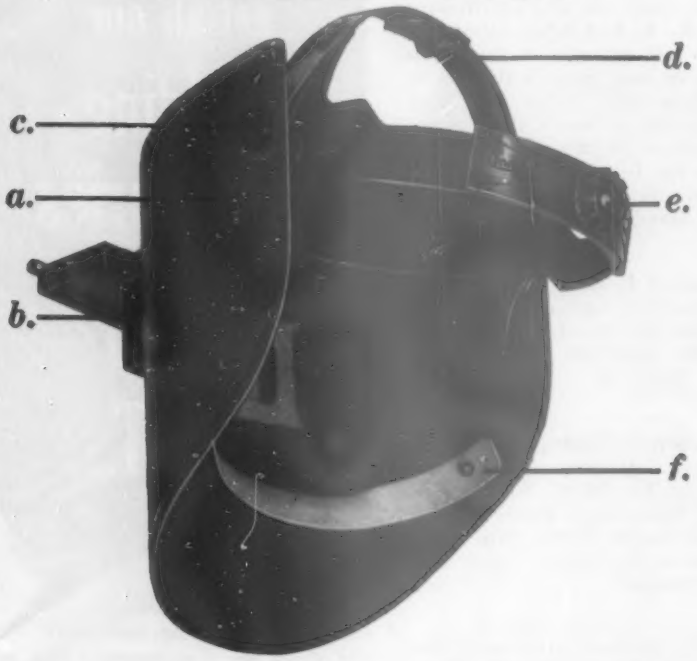
You name the items—M&T will supply them: electrode holders • cables • ground clamps • helmets • durable gloves, etc.

And don't forget these: a thousand types and sizes of electrodes including iron powder, low hydrogen, and stainless. And the complete range of welding equipment including gas engine welders, AC machines, rectifiers and AC-DC units.

Write for data sheet. METAL & THERMIT CORPORATION, General Offices, Rahway, New Jersey.

Circle No. 215 on Info-Aid Card

Next time you pick up your helmet...see if it gives you all the advantages of this OXWELD helmet



a. *One-piece seamless shell* molded from tough glass-fiber-reinforced polyester resin --lightweight, easily cleaned, strong, non-warping.

b. *Flip-front glassholder* die-cast from aluminum, stationary glassholder molded as integral part of shell for a light-tight seal.

c. *Fingertip tension adjustment* to hold helmet in up or down position. "CP" joints of durable plastic will not pass electric current.

d. *Adustable crown strap* holds helmet firmly in choice of five positions.

e. *Rear knob* instantly adjusts headband size over wide range without need for removing helmet.

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LINDE COMPANY

UNION CARBIDE

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The Chamber of Commerce of the United States has elected as president, **Richard Wagner,** chairman of the board and chief executive officer of Champlin Oil and Refining Co., Chicago. **Arthur H. Motley** was elected chairman of the executive committee and **W. B. Camp** was re-elected treasurer.

Monson Welding Sales, Inc., Syracuse, N.Y., has appointed **William A. "Scotty" Rendall** manager of the Schenectady branch office.

Died . . .

Carl L. Risburg, 68, founder and president of Welders Supply Co., Rockford, Ill., died on March 22. Mr. Risburg founded the firm 25 years ago. He served as a sergeant in the U.S. Army in World War I and has since been a member of the American Legion. He is survived by his widow, a son and a daughter. Mr. Risburg was born in Galesburg, Ill., and lived in Rockford for the past 32 years.

Norman Leeds, Jr., 59, assistant general manager of the Rabestos Div., Raybestos-Manhattan, Inc., Stratford, Conn., died on March 12. Mr. Leeds had been with the firm since 1926.

George R. Kanehl, 60, vice president of The Resisto-Loy Co., Inc., Grand Rapids, Mich., died on Feb. 11.

Herman Merker, 63, chairman of the Pressed Steel Tank Co., West Allis, Wis., died on March 14.

William Silas Farmer president of Tolman Mfg. Co., Boston, from 1932 to 1956 died March 8. Mr. Tolman was part owner of Acetylene & Electric Welders Supply Co., Boston.

Mansfield M. Griffith, 48, chief welding engineer at Food Machinery & Chemical Corp.'s ordnance division, San Jose, Calif., died March 5.

Book reviews...

Manufacturers' reps

VERIFIED DIRECTORY OF MANUFACTURERS' REPRESENTATIVE (AGENTS)—3RD EDITION. Published by Manufacturers' Agent Publishing Co., 554 Fifth Avenue, New York 36, N.Y., 1961, 217 pages. Price $20.

Spiral-bound directory lists more than 15,000 manufacturers' domestic and export representatives in the United States, Canada and Puerto Rico. Listings are arranged geographically and include the principal products each "rep" carries and the trading area covered.

In addition, the publication indicates prevailing commission scales for various products, and includes suggested manufacturer-manufacturers' representative contract forms.

Alloy compositions

COMPILATION OF CHEMICAL COMPOSITIONS AND RUPTURE STRENGTHS OF SUPER-STRENGTH ALLOYS. Published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., 12 pages, self cover. Price $1.50.

First issued in 1955, this compilation was originally prepared for committee use only in efforts to write ASTM specifications for high-temperature super-strength alloys.

All known alloys are included. Those no longer in commercial production, as well as experimental alloys, are so indicated.

Metals selection

METALS HANDBOOK, 8TH EDITION, VOL. 1. Published by American Society for Metals, Novelty, Ohio, 1961. Price $30.

Handbook contains more than 2½ times as many pages on selection and properties of metals as the 1958 edition. It offers nearly six times as much numerical information in the form of charts, graphs, and tables.

Emphasis has been placed on relating metals information to engineering and production practice. Over 1,500 examples and 2,806 definitions are included with data compilations on 456 alloys.

Diffuse coatings

DIFFUSE COATINGS ON IRON AND STEEL. Published by the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. By N. S. Gorbunov, Academy of Sciences of USSR, Moscow, 1958, 170 pages. Price $1.25.

The diffusion process of applying successive layers of various protective metal coatings is considered by a leading Russian metallurgical authority as the most promising solution to the problem of protecting iron and steel surfaces from oxidation at high temperatures.

Recently-translated study reports that this successive-layer multicomponent coating technique is more effective than simultaneous application of a single multicomponent coating mixture of protective metals.

Heat treating

HEAT TREATMENT AND PROPERTIES OF IRON AND STEEL. Published by U. S. Dept. of Commerce, National Bureau of Standards, Washington 25, D. C. By Thomas G. Digges and Samuel J. Rosenberg, 1961. 40 pages. Price 35¢.

This monograph has been prepared to answer inquiries on general information concerning heat treatment of iron and steel and for explaining such processes.

It gives, in simplified form, a working knowledge of basic theoretical and practical principles involved in the heat treatment of iron and steel. Effects of various treatments on the structures and mechanical properties of these materials are also described.

Boiler data

BOILERS: TYPES, CHARACTERISTICS, AND FUNCTIONS. Published by F. W. Dodge Corp., 119 W. 40th St., New York 18, N. Y. By Carl D. Shields, 559 pages, clothbound. Price $15.

Covering all practical aspects of the subject, this encyclopedia guide is detailed and understandable.

Thirty-two chapters are organized in six major sections: boiler classification, boiler design, steam generating equipment, boiler construction, industry regulation, industry status. The scope encompasses all information necessary to the person selecting, installing or operating boilers of all types.

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Weld metal cracking

DETERMINATION OF THE CAUSES OF WELD METAL CRACKING IN HIGH STRENGTH STEELS AND THE DEVELOPMENT OF HEAT TREATABLE LOW ALLOY STEEL FILLER WIRES FOR USE WITH THE INERT GAS SHIELDED ARC WELDING PROCESS. Published by the Office of Technical Services, U. S. Department of Commerce, Washington 15, D. C. By H. W. Mishler and others, 1961, 60 pages. Price $1.50.

Two low-cost restrained weld-metal hot-cracking tests that give quantitative measure of weld metal cracking resistance are described in this Air Force metallurgical research report.

The first test described is similar to the standard Lehigh test except that the degree of restraint on the weld metal increases from low to high as the test weld is deposited.

The second test employs apparatus that applies an adjustable restraining force to the test weld.

Development of these tests represents one of four phases of metals research covered in the report.

AWS bibliographies

SUPPLEMENT TO THE AWS BIBLIOGRAPHIES, 1960. Published by the American Welding Society, Technical Department, 33 West 39th Street, New York 18, N. Y., 62 pages. Price $1.50.

The original publication contained bibliographies of articles which appeared in the Welding Journal from 1937 through 1957. Each year a supplement is compiled listing the previous year's articles.

The 1960 supplement can be used as issued or to bring previously issued AWS Bibliographies up-to-date. Format is identical to original and all pages are punched to facilitate insertion into original under respective subject headings.

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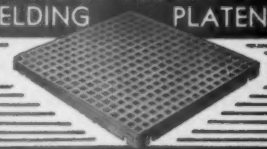

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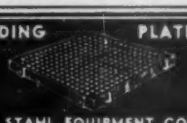

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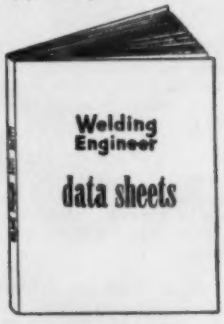

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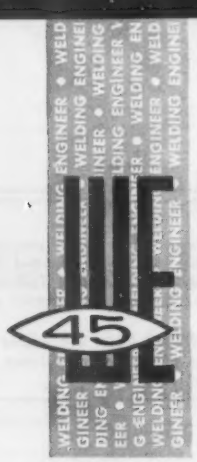

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LITERATURE for your library

97. A-C, D-C CURRENT MEASURING — Columbia Electric Mfg. Co. Form TT-658, eight pages two colors, illustrates and describes a-c, d-c current measuring device.

101. SILICONES—Union Carbide Corp. 16-page illustrated booklet (SF-1000C 1/61) contains information on applications for silicones.

112. A-C VOLTMETER—General Electric Co. One-page bulletin (GEZ-3254) describes features and applications of expanded-scale voltmeter.

114. HARDFACING — Wall Colmonoy Corp. Alloy News Vol. 5 No. 6 contains article on how hydraulic pump valve plate surface life was improved 17 times through hardfacing.

115. SPARK-RESISTANT COPPER — The Beryllium Corp. Bulletin S-1120 describes use in industrial applications of firm's copper for non-sparking trolley wheels.

117. WATER FLOW CONTROL—Van Vooren Products. Literature gives information on cutting water waste by using coolant control designed for use with welders.

119. BULK LIQUID HANDLING — Frommelt Industries, Inc. Illustrated sheet describes fabric or duck cone for filling or removing chemicals, acids or petroleum products from tank cars and containers.

120. IRON BENDER — Hossfeld Mfg. Co. Illustrated sheet (697) gives specifications of various iron benders which can be equipped with hydraulic power.

121. METALLURGICAL RESEARCH—American Society for Metals. 8-page brochure describes electronic system of searching metallurgical and related literature for specific information.

123. INDUSTRIAL GRATING—Dravco Corp. 12-page bulletin 1112 discusses characteristics of a new type of steel industrial grating and facilities for its manufacture and fabrication.

125. ELECTRONIC EQUIPMENT—Allied Radio Corp. 1961 catalog lists such equipment as transistors, test instruments, voltage stabilizers, transformers, capacitors, generators, power supplies and wire and cable.

126. FLEXIBLE SHAFTS—S. S. White Flexible shaft handbook gives statistics, drawings, descriptive material and hitherto unpublished data on flexible shafts.

127. STORAGE TANKS — Chicago Bridge & Iron Co. Illustrated 4-page brochure G-49 tells of design, fabrication and construction of tanks and structures for cryogenics, petroleum, etc.

128. WELDING STUDS — Shielded Stud Welding Co. Eight-page booklet illustrates and gives specifications of shielded welding studs.

129. THERMOPLASTIC EXHAUST SYSTEMS — American Agile Corp. Illustrated 4-page booklet (Vol. IV 11-57) describes thermoplastic, corrosion-proof ventilating and exhaust systems.

130. FIRE PROTECTION — Walter Kidde & Co., Inc. 16-page illustrated color booklet (P-49R1-50M-2-60 Adv.) gives information on complete line of foam, loaded stream, water or antifreeze, carbon dioxide, dry chemical and vaporizing liquid fire extinguishers.

131. VISUAL INSPECTION — American Cystoscope Makers, Inc. Illustrated leaflet (9598) explains close-up visual inspection of internal surfaces and hidden parts with borescope device.

132. RADIOGRAPHIC CAMERAS — Radionics Inc., Catalog sheet describes line of cobalt 60 panoramic radiography cameras.

133. RAILROAD WELDING — Linde Co. Form F-1321A is illustrated 4-page booklet explaining railroad welding and cutting apparatus.

134. ELECTRON BEAM WELDING — Air Reduction Sales Co. Form ADR 128 is 8-page illustrated article on a new electron beam welding unit.

135. FLOW METER — Elematic Equipment Corp. Diagramed sheet is operating instructions for recording flow meter designed for individual cylinder or pipe line use.

136. STEEL PLATE CUTTING — Steffan Mfg. Corp. Form HC-360 describes hand cutter for fast precision cutting of flat or tubular steel plate.

137. QUICK FILM PROCESSING — Eastman Kodak Co. Illustrated form (M3-52) describes unit for 13 minute processing industrial x-ray films.

138. INDUSTRIAL REPAIRING—Devcon Corp. Report deals with specific repairs made by firm's products especially in the heavy marine field.

139. ANODIZE UNIT — Allen Aircraft Products, Inc. Illustrated 4-page booklet explains self-contained hard anodize unit.

140. MULTI-ARC WELDING — J. B. Nottingham & Co., Inc. Multi-operator resistor units for individual control of welding arcs in multi-arc systems are described in 4-page bulletin.

141. ABRASION-RESISTANT STEELS — Jones & Laughlin Steel Corp. Multicolored brochure (AD 286) contains mechanical and chemical information on abrasion-resistant steels.

142. RECTIFIER TUBE — National Electronics, Inc. Sheet shows, describes a new inert-gas filled rectifier tube.

143. SOLDERING FORMS — Kester Solder Co. 4-page illustrated booklet gives information on firm's solder.

144. ABRASIVE CUTTING — Allison-Campbell Div. 4-page illustrated form (Dh-460-D) describes wet abrasive cutoff machines.

145. AIR HOISTS — Gardner-Denver Co. Form No. 26, illustrated, 4-pages, gives information on compact air hoists.

146. INSULATION WELDING — Duro Dyne Corp. Illustrated booklet gives method of shop installing insulation pins.

147. HEAT RECORDER — Heat-Timer Corp. 4-page illustrated form describes heat recorder-totalizer for use with any heating system.

148. BACKING RINGS — Robvon Backing Ring Co. Illustrated sheet gives basic information on type CCC backing rings.

149. SANDING DISCS — The Carborundum Co. Form No. A 1558 is illustrated form explaining uses of sanding discs for such jobs as surfacing heavy-duty welds.

150. PLASTIC WELDING — D & R Plastic Welders, Inc. 12-page illustrated color catalog gives applications and describes equipment needed for welding plastic.

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208. **Alloy Rods Co.** — For additional information on "Wear-O-Matic WH" welding wire, send for Bulletin AR-21.

172. **All-State Welding Alloys Co., Inc.** Catalog and manual on "Steelarc" cutting electrode and chamfer rod, available.

168. **Alva Allen Industries**—Catalog available on heavy duty punch presses manufactured by Alva Allen, giving specifications and prices.

178. **Bateman Foundry & Machine** — Complete information on the "Bantam" iron worker and name of your nearest distributor is available.

154. **Bernard Welding Equipment Co** —Bulletin SS7 on the "Shortstub" electrode holder is available.

193. **Bridgeport Brass Co.**—Bronze welding booklet available on Bridgeport welding rods.

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173. Cam-Lok Div.—Catalog available on Receptacles and Plugs, for power connections.

179. Fibre-Metal Products Co.—Bulletin No. T2-R on "SuperGrip" ground clamps available.

218. Galv-Weld Products—Write for information and sample of galvanizing manufactured by Galv-Weld.

156. Glenn Pacific Corp.—Literature, specifications and prices on the new Glenn AC/DC power supply for TIG welding.

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195. Handy & Harman—Bulletin 2f available on silver brazing and its benefits, including details on alloys, heating methods, joint design and production techniques.

151. Hobart Brothers Co.—Bulletin DM-159 gives further information on "Micro-Wire" welding package, which feeds wire automatically for all position welding.

187. The International Nickel Co., Inc. — Booklet available, "A Handy Guide to Welding Cast Irons," further explains the use of "Ni-Rod 55" electrodes.

185. Invincible Vacuum Cleaner Manufacturing Co.—A flux recovery equipment folder is available.

216. Linde Co.—Literature and price list on the "Oxweld" helmet available.

153. Manhattan Rubber Div.—Bulletin 7157 further explains the "Safety Back Flared Cup" and other heavy duty abrasive wheels manufactured by Manhattan.

171. Markal Co.—Literature on "Thermomelt" available and sample pellets.

163. Merrill Brothers—Catalog C-3 available on the large opening "C" clamp and other material handling devices.

215. Metal & Thermit Corp.—Data sheets available on the "Muretran" all purpose welder and other "Murex" welders.

176. Metco Inc.—Bulletin on hardfacing with "ThermoSpray" is available from Metco.

183. Oxo Welding Equipment Co. — Catalog available describing the complete line of welding fittings manufactured by Oxo.

160. Pressed Steel Tank Co.—Cylinder catalog available, "Hackney Compressed Gas Cylinders."

211. Riegel Textile Corp.—"Work Glove Selector Guide" is available on styles, types, materials, chemical resistance, and case histories, of weldors gloves, manufactured by Riegel.

191. A. O. Smith Corp. — Circle No. 191 on the Welding Info-Aid Card for a free sample of the W610 electrode to test in your shop.

190. Stoody Company — Detailed "Crushermatic" data is available on automatically rebuilding crusher rolls in position.

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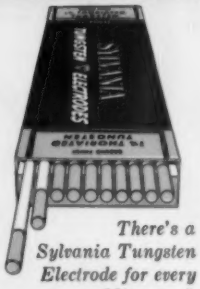

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